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02 AIRCRAFT
Includes fixed-wing airplanes, helicopters, gliders, balloons, ornithopters, etc; and specific types of complete aircraft (e.g., ground effect machines, STOL, and VTOL); flight tests; operating problems (e.g., sonic boom); safety and safety devices; economics; and stability and control. For basic research see: 01 Aerodynamics. For related information see also: 31 Space Vehicles; and 32 Structural Mechanics. **1553**

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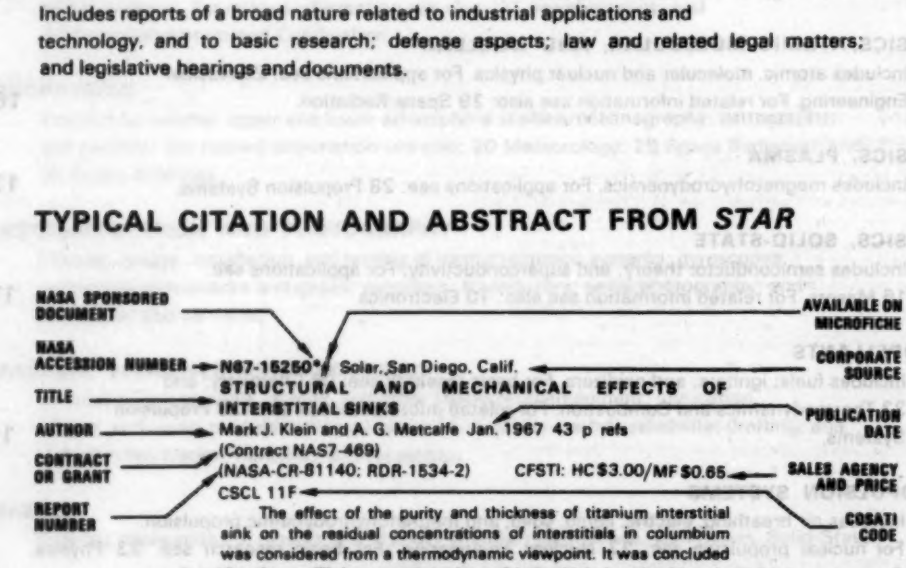
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STRUCTURAL AND MECHANICAL EFFECTS OF INTERSTITIAL SINKS
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Mark J. Klein and A. G. Metcalfe Jan. 1967 43 p refs
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The effect of the purity and thickness of titanium interstitial sink on the residual concentrations of interstitials in columbium was considered from a thermodynamic viewpoint. It was concluded that the equilibrium concentrations of interstitials in columbium is not a sensitive function of these parameters. The structure and hardness of Ti/D-43 diffusion couples were correlated with the partitions of interstitials between the two metals. A reduction in the oxygen and carbon concentration in the D-43 correlates with an increase in the grain size and a change in the grain morphology of this alloy. The equilibrium partition of interstitials between the titanium and the D-43 is believed to account for an increase in the hardness of the titanium but this partition does not seem to affect the hardness of the D-43.
Author

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Scientific and Technical Aerospace Reports

A Semi-monthly Publication of the National Aeronautics and Space Administration

01 AERODYNAMICS

Includes aerodynamics of bodies, combinations, internal flow in ducts and turbo machinery; wings, rotors, and control surfaces. For applications see: 02 Aircraft and 31 Space Vehicles. For related information see also: 12 Fluid Mechanics; and 33 Thermodynamics and Combustion.

N67-20609# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.

SUBSONIC FLOW VISUALIZATION AND AERODYNAMIC FORCE TESTS ON CONES

Wayne W. Gamble (M.S. Thesis) Jun. 1966 76 p refs

(GAM/AE/66B-12; AD-642360) CFSTI: HC $3.00/MF $0.65

An aluminum cone with an apex angle of 60 degrees was tested. Lift, drag and pitching moment were measured at angles of attack from -5 to 90 degrees and from 90 to 180 degrees at dynamic pressures of 100 lb./sq. ft. and 75 lb./sq. ft., respectively. The fluorescent-oil film method was used for surface flow visualization. Observations of oil-flow patterns, illustrated with photographs, are described for angles of attack from 0 to 180 degrees. The force data was corrected for tare, interference and three-dimensional wind tunnel effects; this was plotted in coefficient form versus angle of attack. Abrupt changes in forces near 72 degrees angle of attack were caused by separation of a complex flow phenomenon on the downwind lateral surface of the cone. The oil flow on the lateral surface of the cone near 90 degrees angle of attack was found to be similar to the oil flow observed on a right circular cylinder. Author (TAB)

N67-20629# Lockheed-California Co., Burbank.

DEVELOPMENT DESIGN METHODS FOR PREDICTING HYPERSONIC AERODYNAMIC CONTROL CHARACTERISTICS Final Report, 2 Jun. 1965–15 Apr. 1966

Zenon Popinski and Carl F. Ehrlich Wright-Patterson AFB, Ohio. AF Flight Dyn. Lab., Sep. 1966 268 p refs

(Contract AF 33(615)-2512)

(LR-19460; AFFDL-TR-66-85; AD-644251) CFSTI: HC $3.00/MF $0.65

Design methods are developed for determining aerodynamic control effectiveness at hypersonic speeds along body surface. Pressure and heat transfer distributions in separated regions due to aerodynamic control deflection are described in terms of characteristic magnitudes and distance parameters by semiempirical correlations. The forms of these correlations are inferred from theory and experimental data. Using these correlations, pressure distribution in the separated region over a deflected flap is approximated and expressions for force and moment coefficients are determined. General charts are developed which present separation and flow parameters over a range of flight conditions for a typical hypersonic vehicle. Flow separation over a fin-plate configuration is presented using experimental measurements. Also, characteristics of flow over a flat plate, flat delta wing, and delta with dihedral are analyzed using visual flow records and pressure measurements from the point of view of two-dimensional flow. Applicability of the correlation expressions to separated flow on various configurations is discussed and calculated aerodynamic coefficients are compared with measured values. Author

N67-20646# Cornell Aeronautical Lab., Inc., Buffalo, N. Y.

WAKES OF LIFTING PROPELLERS (ROTORS) IN GROUND EFFECT Final Report Feb. 1965–May 1966

F. A. DuWaldt Nov. 1966 96 p ref

(Contract Nonr-3691(00))

(BB-1665-S-3; AD-643159) CFSTI: HC $3.00/MF $0.65

The report presents the development of a wake model for a lifting propeller (rotor) in ground effect and the computational procedure used to determine the spacial distribution of wake vorticity and the induced velocity field accompanying that vorticity distribution. Sample calculations for a two-bladed rotor were carried out on an IBM 7044 computer. Locations of wake vortical elements and the associated induced velocities at selected field points are presented for advance ratios of 0, 0.02, 0.05, and 0.10 for an h/r (ratio of rotor height above ground to rotor radius) of 1.0. Also, a few results for a hovering case with h/r=0.5 are presented. A calculated root-mean-square velocity map is compared with measured hovering data (time averaged) and good agreement is obtained in the outer half of the slipstream. The implications of computed results with respect to the flow field at a horizontal stabilizer or tail rotor are noted as examples of the use of the model. The wake vortex model used for these calculations is a distorted continuous helix emanating from each blade tip. Author (TAB)

N67-20722# Aeronautical Research Council (Gt. Brit.)

EFFECTS OF LONGITUDINAL ELASTIC CAMBER ON SLENDER AIRCRAFT IN STEADY SYMMETRICAL FLIGHT, PARTS I AND II

A. S. Taylor and W. F. W. Urich London, HMSO, 1966 95 p refs Supersedes RAE-TN-AERO-26841, RAE-TN-STRUCT-296, ARC-25763, ARC-26192

(ARC-R&M-3426, RAE-TN-AERO-2684, RAE-TN-STRUCT-296, ARC-25783, ARC-26192; AD-803251) HMSO: £1 17s

An approximate method of estimating the effect of aeroelasticity on the longitudinal trim and quasi-steady manoeuvrability of slender aircraft has been developed. It is assumed that, structurally, the aircraft behaves as a "free–free" beam, subject only to longitudinal bending, and that the total chordwise aerodynamic loading (including that due to elastic camber) varies linearly with local angle of attack, and is thus calculable by superposition of a number of 'elementary' distributions. It is then possible to set up the differential equation for the deflected beam, and by solving it on a digital computer, in conjunction with the

equations of over-all equilibrium, obtain the distributions of elastic camber, the angles of attack of the centerline chord and the elevon angles appropriate to the aircraft in trimmed level flight and in the steady pull-up manoeuvre. The theory is developed in detail for the cases where the loading due to elastic camber is assumed to be in accordance with slender-wing theory and piston theory respectively. The practicability of the method has been demonstrated by application (using slender-wing theory) to a possible design for a supersonic transport aircraft, and from the calculations, some tentative conclusions have been drawn regarding the likely order of the effects for such an aircraft. Author (TAB)

N67-20899# Sandia Corp., Albuquerque, N. Mex.
A SIX-DEGREE-OF-FREEDOM INVESTIGATION OF THE MOTION OF TWO SNAP FUEL CAPSULE CONFIGURATIONS RE-ENTERING THE ATMOSPHERE WITH VARIOUS INITIAL CONDITIONS
D. H. Johnson Sep. 1966 26 p refs
(Contract AT(29-1)-789)
(SC-TM-66-393) CFSTI: HC $3.00/MF $0.65

The aerodynamic characteristics of two SNAP fuel capsule configurations were determined by using Newtonian theory. For one of these configurations (a cylindrical body with hemispherical end caps), several six-degree-of-freedom trajectories were run using the NASA Six-Degree-of-Freedom Program on the IBM 790 machine in order to study its motion as it re-entered the atmosphere from orbit around the earth. Particular attention was paid to the tumbling motion. Also, a literature search was made to determine what has been done in the way of measuring the aerodynamic characteristics of right circular cylinders. A summary of the available experimental data is given, and a bibliography is included in the report. Author (NSA)

N67-21181 Aeronautical Research Council (Gt. Brit.)
ANALYSIS OF HINGE MOMENT DATA FOR RECTANGULAR AND NEAR RECTANGULAR TRAILING EDGE CONTROLS AT SUPERSONIC AND TRANSONIC SPEEDS
D. Isaacs 1966 57 p refs Supersedes RAE-TR-65105; ARC-27227; See X66-10900
(ARC-CP-874; RAE-TR-65105; ARC-27227) CFSTI: HC $3.00/MF $0.65

Similarity rules have been used at supersonic and transonic speeds to obtain a correlation of available experimental data on hinge moment curve slope, $(dC_H/d\alpha)$, and to compare the experimental values with theoretical estimates. The effects of varying control aspect ratio, thickness chord ratio, body interference, hinge line location, and trailing edge thickness are examined, suitable theoretical or empirical methods for predicting these effects are indicated, and their range of validity and accuracy determined. Author

N67-21185 Aeronautical Research Council (Gt. Brit.)
THE FLAPPING BEHAVIOUR OF A HELICOPTER ROTOR AT HIGH TIP-SPEED RATIOS
E. Wilde, A. R. S. Bramwell, and R. Summerscales 1966 37 p refs Supersedes RAE-TR-65068; ARC-27375; See N66-22232
(ARC-CP-877; RAE-TR-65068; ARC-27375) CFSTI: HC $3.00/MF $0.65

The blade flapping equation has been solved on an analogue computer taking into account the reversed flow region but neglecting stall. The fully articulated blade becomes unstable at about $\mu = 2.3$, whilst a see-saw rotor is stable up to $\mu = 5$ at least and the trends suggest that it may be stable for all values of μ. However, the response to a gust, or the equivalent change of no-feathering axis angle, is almost the same for both rotors up to about $\mu = 0.75$. For a 35 ft/sec gust at a forward speed of 200 ft/sec, and typical rotor/fuselage clearance, this represents the limiting tip-speed ratio for either rotor. The better response of the see-saw rotor, however, makes it possible to increase the limiting tip-speed ratio by some form of flapping restraint. This has been investigated by considering the effects of springs and dampers, and offset and δ_3-hinges. Author

N67-21186 Aeronautical Research Council (Gt. Brit.)
THE PERFORMANCE OF A CENTRE BODY PROPELLING NOZZLE WITH A PARALLEL SHROUD IN EXTERNAL FLOW, PART II
M. V. Herbert, G. T. Golesworthy, and R. J. Herd 1966 69 p refs Supersedes NGTE-M-384; ARC-25992; See X65-12968
(ARC-CP-894; NGTE-M-384; ARC-25992) CFSTI: HC $3.00/MF $0.65

In continuation of the work on axisymmetric centrebody nozzles with translating parallel outer shrouds and fixed throat areas, further tests have been carried out with external flow in the range of Mach number 0.7 to 1.5. For combinations of exhaust pressure ratio and external Mach number representative of flight requirements, the results show that this type of nozzle can offer quite a high level of gross thrust efficiency throughout its operating range. The off-design performance is much superior to that of a plain convergent–divergent nozzle of the same design pressure ratio. Conical centrebodies only were used, and the effect of varying the half-angle from 15 to 7-1/2° has been investigated. Some improvement is gained by going to 10°, but further reduction is unlikely to be worthwhile in practice. Author

N67-21189# Aeronautical Research Council (Gt. Brit.)
WIND-TUNNEL EXPERIMENTS ON THE FLOW OVER RECTANGULAR CAVITIES AT SUBSONIC AND TRANSONIC SPEEDS
J. E. Rossiter 1966 36 p refs Supersedes RAE-TR-64037; ARC-26621; See X65-13105; X66-18397
(ARC-R&M-3438; RAE-TR-64037; ARC-26621) CFSTI: HC $3.00/MF $0.65

Measurements were made of the time average and unsteady pressures acting on the roof and behind a series of rectangular cavities set in the roof of the 2 ft × 1-1/2 ft transonic tunnel. It was found that the unsteady pressures contain both random and periodic components. The random component predominates in the shallower cavities (length/depth ratio > 4) and is most intense near the rear wall. The periodic component predominates in the deeper cavities (length/depth ratio < 4) and may form standing wave patterns. It is suggested that the periodic component is due to an acoustic resonance within the cavity excited by a phenomenon similar to that causing edge-tones. It may be suppressed by fixing a small spoiler at the front of the cavity. Author

N67-21190# Aeronautical Research Council (Gt. Brit.)
A DEVELOPED THEORY OF SPOILERS OF AEROFOILS
C. S. Barnes 1966 83 p refs Supersedes ARC-27123; See X66-11936
(ARC-CP-887; ARC-27123) CFSTI: HC $3.00/MF $0.65

A theory for the lift and pitching moment coefficients due to two-dimensional normal spoilers on aerofoils in incompressible flow was developed from that of Woods. By making use of experiments on a symmetrical aerofoil fitted with spoilers, the displacement thickness of the boundary layer at the spoiler position and a measure of the pressure in the separated region behind the spoiler were taken into account. These empirical modifications led to good agreement with experiment over a range of aerofoil incidence. Since a change of incidence is similar in many respects to a change of aerofoil shape it appeared likely that the modified theory would apply over a wide range of aerofoil sections. Further

experiments upon an aerofoil of considerably different shape provided confirmation, good agreement being obtained between theory and experiment. A limited series of experiments was made on spoilers of finite span upon the original aerofoil. For spoilers of span greater than 80% of the aerofoil chord it was found that their lift and pitching moment increments could be correlated roughly with those due to two-dimensional spoilers. Author

N67-21191# Aeronautical Research Council (Gt. Brit.)
THE CALCULATION OF GENERALISED FORCES ON OSCILLATING WINGS IN SUPERSONIC FLOW BY LIFTING SURFACE THEORY
G. Z. Harris 1966 45 p refs Supersedes RAE-TR-65078; ARC-27107; See X65-1880
(ARC-R&M-3453; RAE-TR-65078; ARC-27107) CFSTI: HC $3.00/MF $0.65

A numerical method of solving the integral equation connecting the lift and downwash on a wing oscillating harmonically in a supersonic flow of any Mach number is described. The integral equation is replaced by a matrix equation connecting the values of the lift and downwash at set of points on the wing, and the generalised aerodynamic forces acting on the wing are found simply as a matrix product. Comparisons are made between aerodynamic derivatives calculated by this method, and theoretical and experimental derivatives from other sources. Author

N67-21196# Aeronautical Research Council (Gt. Brit.)
NOTES ON DUCTED FAN DESIGN
R. C. Turner 1966 39 p refs Supersedes NGTE-M-386; ARC-26603; See X65-12969
(ARC-CP-895; NGTE-M-386; ARC-26603) CFSTI: HC $3.00/MF $0.65

In general, conventional compressor stages are designed by the cascade method, while high stagger low solidity ducted fans are designed on modified isolated aerofoil theory. The purpose of these notes is to provide a basis for discussion on the relative merits of the two methods and on the desirability of extending one method to cover the whole range of blading likely to be required in compressors and fans. Attention has been mainly confined to low speed two-dimensional considerations. It is suggested that the cascade approach could provide a basis for the formulation of a unified design method. A project of this nature would necessitate a programme of testing and performance analysis of typical fans; high stagger cascade tests might also provide supporting data, although there could be doubts as to their significance. Author

N67-21197# Aeronautical Research Council (Gt. Brit.)
THE PERFORMANCE OF A CONICAL CONVERGENT–DIVERGENT NOZZLE WITH AREA RATIO 2.9 IN EXTERNAL FLOW
G. T. Golesworthy and M. V. Herbert 1966 29 p refs Supersedes NGTE-M-271; ARC-26491; See X65-12966
(ARC-CP-891; NGTE-M-371; ARC-26491) CFSTI: HC $3.00/MF $0.65

A model internal-expansion propelling nozzle with conical divergence of 10° semi-angle, area ratio 2.9 (design pressure ratio 20), parallel afterbody and thin annular base, has been tested both in quiescent air and in external flow over the range of Mach No. 0.7 to 2.4. Measurements have been made of nozzle base pressure, and thrust efficiencies derived with reference to both ambient and base pressure levels. Internal thrust efficiencies with external flow agree with those in quiescent air, provided that the boundary layer is in the same state in both cases. Author

N67-21199# Aeronautical Research Council (Gt. Brit.)
THE EFFECT OF EXTERNAL FLOW ON THE INTERNAL-EXPANSION PROPELLING NOZZLE INCORPORATING VENTILATION BY AMBIENT AIR
M. V. Herbert, C. Overy, R. A. Pinker, and G. T. Golesworthy 1966 55 p refs Supersedes NGTE-M-393; ARC-26719; See X65-13666
(ARC-CP-897; NGTE-M-393; ARC-26719) CFSTI: HC $3.00/MF $0.65

Previous attempts to improve the off-design performance of a convergent-divergent nozzle evolved the principle of "ventilation". This provides for the transmission of ambient pressure to the over-expanded divergent surfaces, by means of small quantities of secondary air induced from atmosphere. The technique was developed to operate satisfactorily at low pressure ratio in quiescent air, using successive stages of secondary air admission. A penalty is paid, however, in that design-point performance is somewhat reduced. In external flow, low nozzle base pressures are created, supplanting ambient pressure as the environment into which the nozzle exhausts. With a fairly high subsonic or transonic external stream, ventilation was found incapable of raising the level of base pressure. Under these conditions, the technique offers no useful improvement in nozzle internal performance at low pressure ratio. Author

N67-21200# Aeronautical Research Council (Gt. Brit.)
FURTHER TESTS ON A THREE-STAGE TURBINE OF LOW REACTION TO EXAMINE THE EFFECTS OF REDUCED ROTOR PITCH AND IMPROVED SEALING
I. H. Johnston and D. C. Dransfield 1966 30 p refs Supersedes NGTE-M-388; ARC-26623; See X65-12886
(ARC-CP-861; NGTE-M-388; ARC-26623) CFSTI: HC $3.00/MF $0.65

Reductions have been made to the rotor blade spacing, stator tip clearance, and internal leakage flows in a previously tested three-stage experimental turbine of high stage loading. The separate effects of these modifications on overall performance have been determined by further tests; the combined effect being to increase the overall design point efficiency from 82 per cent to 86-1/2 per cent, approximately. The results are discussed in the light of other data and partial agreement between the test performance and generalised estimates is established. Author

N67-21337# White Sands Missile Range, N. Mex. Atmospheric Sciences Lab.
A REFINEMENT TECHNIQUE FOR UNGUIDED ROCKET DRAG COEFFICIENTS
Larry E. Taylor Oct. 1966 19 p refs
(ECOM-5084; AD-644816) CFSTI: HC $3.00/MF $0.65

A technique for approximating the drag coefficients from radar beacon tracks of previously fired unguided rockets is presented. Corrections for the effect of wind conditions at launch and for the Coriolis and centripetal accelerations due to the rotation of the radar with the earth are included, but the yaw angle is assumed to be zero. Author (TAB)

N67-21380# Ballistic Research Labs., Aberdeen Proving Ground, Md.
PRELIMINARY RADIATION MEASUREMENTS OF HIGH SPEED FLOWS OVER CYLINDERS AND SPHERES
Wallace H. Clay Mar. 1966 32 p refs
(BRL-TN-1607; AD-637269) CFSTI: HC $3.00/MF $0.65

Caliber 30 Lexan cylinders, 1/4 inch saboted Lexan spheres, and 1/4 inch saboted ceramic spheres were fired. Instrumentation was developed to measure the radiation emitted from these models for various range conditions. The investigation was restricted primarily to the near infrared spectral region, but some measurements

were made in the visible region. Some preliminary results are presented to show that this instrumentation can provide reliable measurements of radiation from the model and its wake.
Author (TAB)

N67-21382*# Israel Program for Scientific Translations, Ltd., Jerusalem.
THE DESIGN OF MODELS FOR AERODYNAMIC EXPERIMENTS
In its Wind Tunnels and Their Instrumentation 1966 p 3-12 refs (See N67-21381 10-11) CFSTI: HC $3.00/MF $0.65

Similarity criteria are discussed for models commonly used in wind tunnels of limited dimensions to predict the behavior of prototypes in flight. The accuracy of predictions from tests on models depends on the criteria of similarity or the fidelity with which flow around the model or in a channel of limited size reproduces the flow around the full-scale body or in the full-scale channel. Two systems are defined as being similar to each other if all the physical characteristics at corresponding points in the two systems have the same relationship. The more complicated conditions for the mechanical similarity of motion in fluids of geometrically similar, similarly placed solid bodies are presented. Allowance is made for inertia, viscosity, compressibility, and thermal conductivity (neglecting buoyancy and radiant heat transfer). In the discussions it is assumed that other things being equal the same velocities in the two systems corresponded to equal forces. The velocity, fixed, and semifixed coordinate systems used in experimental aerodynamics and aircraft designs are described, and aerodynamic coefficients are given.
S.P.

N67-21412 National Aerospace Lab., Tokyo (Japan).
SOME HIGH-SPEED TESTS ON IMPULSE TURBINE CASCADES
Hiroshi Kondo, Mitsuhiro Minoda, Norio Yamazaki, and Noboru Furukawa 1966 56 p refs In JAPANESE; ENGLISH summary
(NAL-TR-108) CFSTI: $3.00

High speed cascade tunnel tests on two cascades of turbine blades are described, the blades having aerofoil sections of impulse design. The two-dimensional performance over narrow ranges of incidence, stagger angle and pitch-chord ratio at Mach numbers up to 1.1 is discussed, special importance being attached to the comparison with performance of cascades of blades having conventional sections. It is shown that at high Mach numbers the effect of increasing stagger angle is to reduce the total-head loss, while the $\cos^{-1}$throat/pitch rule is found to be not always true.
Author

N67-21413 National Aerospace Lab., Tokyo (Japan).
A STUDY ON THE LARGE-SCALE AIR EJECTOR
Shoichi Fujii, Mitsuo Gomi, and Noboru Sugahara 1966 32 p refs *In* JAPANESE; ENGLISH summary
(NAL-TR-109) CFSTI: $3.00

Exploratory experiments were carried out to determine the performance of a center-jet type ejector. The ratio of combining-tube area to driving-nozzle area was varied in two steps (namely, 6.8 and 9.0), covering a range of mass ratios from 0 to 1.4, and compression ratios ranging from 1.03 to 1.38. Efforts were made to develop a mathematical analysis concerning the mixing of two-streams confined by constant-area duct. In this analytical treatment the concept of mixing-length was employed using the assumption of approximate self-preservation. The experimental results lead to a tentative conclusion that the performance of large-scale air-ejectors may be roughly predictable from those of small-size ejectors. It is also shown analytically that the mixing-lengths of turbulent fluids in the ejector range from about 0.1 to 0.2 times the semi-diameter of the combining tube, according to the mode of action.
Author

N67-21414 National Aerospace Lab., Tokyo (Japan).
AN ASYMPTOTIC SOLUTION OF THE NONLINEAR EQUATIONS OF MOTION OF AN AIRPLANE
Hiroshi Endo Aug. 1966 16 p refs
(NAL-TR-111T) CFSTI: $3.00

A method of solving the nonlinear equations of motion of an airplane is studied assuming that the nonlinear effect is small, and that the damping of a single oscillatory mode is weak. This is essentially a practical extension of the theory of nonlinear oscillation by Bogoljubov and Mitropol'skii, to airplane dynamics. The procedures of constructing the asymptotic solution of the critical mode are illustrated. A numerical example is given in respect to the Duth roll stability in a low speed flight condition, in which the nonlinearity is introduced by the transient stall at the wing tip due to the disturbance in roll. Especially estimated is the time to half, or otherwise the time to double, of the amplitude of perturbed motions as a criterion of stability, which is hereby proved to be dependent on the initial amplitude of disturbance. This makes a distinct feature of nonlinear oscillation.
Author

N67-21415 National Aerospace Lab., Tokyo (Japan).
A THEORETICAL INVESTIGATION OF THE COMPRESSIBLE FLOW THROUGH THE AXIAL TURBO-MACHINES (SECOND REPORT)
Shoichi Fujii 1966 41 p refs *In* JAPANESE; ENGLISH summary
(NAL-TR-112) CFSTI: $3.00

Data are presented on the behavior of a swirling flow passing through a row of stationary or rotating cascades replaced by an infinitely thin annular disk. A single parameter (S(z)) is used to describe the radial velocity profile; the axial velocity shapes are considered to be dependent on the differentiation of S(z) with respect to the axial coordinate z. Also presented is a theory of the three-dimensional flow induced by a single row of stationary or rotating blades with finite blade chord and prescribed loading. The numerical solutions are compared with the corresponding discontinuous approximations.
Author

N67-21419# Aeronautical Research Council (Gt. Brit.)
ON THE PREDICTION OF BASE PRESSURE IN TWO-DIMENSIONAL SUPERSONIC TURBULENT FLOW
J. B. Roberts 1966 45 p refs Supersedes NGTE-R-265; ARC-26720; See X65-13384
(ARC-R&M-3434; NGTE-R-265; ARC-26720) CFSTI: HC $3.00/MF $0.65

The theory of base pressure prediction in two-dimensional supersonic turbulent flow is discussed, and, in the light of investigations of jet mixing, various modifications to the analysis of the flow model are suggested. A comparison is made of some reattachment criteria, and a Mach number ratio is proposed as a simple criterion, which correlates the experimental data satisfactorily.
Author

N67-21702# Princeton Univ., N. J. Dept. of Aerospace and Mechanical Sciences.
LATERAL-DIRECTIONAL FLYING QUALITIES FOR POWER APPROACH Final Report, May 1964-Sep. 1966
Edward Seckel, George E. Miller, and Walter B. Nixon Sep. 1966 144 p refs
(Contracts Nonr-1858(50); N600(19)59256)
(Rept.-727; AD-644831) CFSTI: HC $3.00/MF $0.65

Simulated carrier approaches were flown by Navy carrier pilots in a variable stability Navion airplane. The approaches were visual, in daylight, at a closure speed of 105 knots. Moderate natural turbulence and the carrier turbulence wake were simulated. Lateral-directional handling qualities data in the form of Cooper rating number and pilot commentary were obtained for variations in control sensitivity, roll damping, dihedral effect, numerator transfer

function characteristics. Dutch roll damping, and magnitude of turbulence. The data are presented as iso-opinion maps of the parameters. Turbulence was found to be a factor of commanding importance in the handling qualities of a configuration. The poor handling qualities normally associated with large values of Dutch roll bank to sideslip ratio were found to be chargeable to the large value of the dihedral effect and the associated sensitivity to turbulence. Very low values of dihedral effect were objectionable because of the yawing motions excited by turbulence.
Author (TAB)

N67-21706# Israel Inst. of Tech., Haifa. Dept. of Aeronautical Engineering.
THE FLOW FIELD IN THE TURBULENT SUPERSONIC NEAR WAKE BEHIND A TWO-DIMENSIONAL WEDGE-FLAT PLATE MODEL
J. Rom, A. Seginer, and J. Kronzon Aug. 1966 93 p refs Prepared in cooperation with Technion Res. and Develop. Found., Ltd.
(Contract AF 61(052)-578)
(TAE-54; ISR-6; AD-645219) CFSTI: HC$3.00/MF$0.65

Pitot pressure and recovery temperature profiles are measured at various distances downstream behind a two-dimensional blunt base in the turbulent near wake at Mach numbers 2.25 and 3.5. These results are used for the determination of total and static pressure profiles and Mach number distributions in the near wake. The flow structure of the near wake is also obtained by shadow and Schleiren photographs. A flow visualization technique using oil streaks which are obtained from oil film deposited on the model surfaces and carried into the wake flow was found useful. All these results are integrated to obtain a description of the various intricate physical phenomena observed in the two dimensional near wake flow.
Author (TAB)

N67-21734# University of Southern Calif., Los Angeles. School of Engineering.
ON THE NEWTONIAN HYPERSONIC STRONG-INTERACTION THEORY FOR FLOW PAST A FLAT PLATE
William B. Bush Sep. 1966 19 p refs
(Grant AF-AFOSR-697-66)
(USCAE-102; AFOSR-66-2408; AD-643273) CFSTI: HC $3.00/MF$0.65

The viscous hypersonic flow past the leading edge of a sharp flat plate, whose surface is parallel to an oncoming uniform flow, is analyzed on the basis of a continuum model consisting of the Navier-Stokes equations and the velocity-slip and temperature-jump wall boundary conditions. It is assumed that the model fluid is a perfect gas having constant specific heats, a constant Prandtl number whose numerical value is order unity, and a normal viscosity coefficient varying as a power of the absolute temperature. Limiting forms of the solutions for such a flow are studied as: (1) the free-stream Mach number, M, goes to infinity; (2) the free-stream Reynolds number based upon the distance from the leading edge goes to infinity; and (3) the Newtonian parameter goes to zero.
Author (TAB)

N67-21742# Toronto Univ. (Ontario). Inst. for Aerospace Studies.
A COMPUTER STUDY OF A WING IN A SLIPSTREAM
N. D. Ellis Feb. 1967
(UTIAS-TN-101) CFSTI: HC$3.00/MF$0.65

A Fortran IV program for the IBM 7094-II digital computer has been formulated based on a theory of wing-slipstream interference by Ribner which accounts for the slipstream effects by means of vortex sheath. This sheath together with the wing vorticity lead a pair of simultaneous integral equations for the unknown circulations. A stepwise approximation to the circulations reduces the pair to a system of linear algebraic equations. The format has been modified from that of the earlier work to facilitate inversion of the equations by computer. This first program has been restricted for simplicity to the case of a slipstream centered on a rectangular wing. The printout yields circulation, span loading, integrated lift and other properties. The results show a progression from approximately 'slender body theory' for very narrow slipstreams to 'strip theory' for very broad slipstreams and compare well with experimental data.
Author

N67-21874# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
COLLECTED WORKS II
A. I. Nekrasov 27 Jun. 1966 765 p Transl. into ENGLISH of the Book "Sobraniye Sochineniy, II" Moscow, Izd. an SSSR, 1963 p 1-706
(FTD-MT-64-386; AD-645786) CFSTI: HC$3.00/MF$0.65

Aerohydromechanics: (theory of the wing in an unsteady flow; special mathematical and mechanical questions, frequently encountered in this monograph; the theory of Karman and Sears; the theory of the Moscow School; Birnbaum's integral equation; aerodynamic forces and moments acting on the profile; aperiodic motion; vibrating profile in a compressible fluid; a wing of finite span in a nonstationary flow; motion of a profile with constant circulation; the theory of flutter; theoretical and applied mechanics.
Author (TAB)

02 AIRCRAFT

Includes fixed-wing airplanes, helicopters, gliders, balloons, ornithopters, etc; and specific types of complete aircraft (e.g., ground effect machines, STOL, and VTOL); flight tests; operating problems (e.g., sonic boom); safety and safety devices; economics; and stability and control. For basic research see: 01 Aerodynamics. For related information see also: 31 Space Vehicles; and 32 Structural Mechanics.

N67-20578# LTV Aerospace Corp., Dallas, Tex. Vought Aeronautics Div.
RESEARCH ON VTOL WATER HOVER EFFECTS
K. R. Marsh 30 Sep. 1966 146 p refs
(Contract N0014-66-C0095)
(Rept.-2-55400/6R-6090; AD-642938) CFSTI: HC $3.00/MF $0.65

A series of tests were made with a powered model of the XC-142A airplane hovering over ground and over a water filled tank. Six component measurements were made of the forces and moments acting on the model, measurements were made of the water spray recirculated thru the outboard propeller and pictures were taken of the spray patterns developed. The force data showed a slight reduction in model normal force when hovering over water rather then the ground. There was considerable scatter in the moment data. Measurements of spray being recirculated thru the prop were found to be tolerable even at the most critical conditions. While there was considerable spray generated by the downwash, it was blown away from the model leaving the model relatively clear of spray.
Author (TAB)

N67-20589# All American Engineering Co., Wilmington, Del.
AIRCRAFT CARGO RESTRAINT SYSTEM
A. Russo Sep. 1966 177 p refs
(Contract DA-44-177-AMC-68(T))
(USAAVLABS-TR-66-50; AD-643520) CFSTI: HC$3.00/MF$0.65

An investigation was made of the restraint requirements for Army cargo in Army aircraft, presenting realistic criteria for cargo restraint systems with the formulation of feasible restraint concepts. The existing static load factor criterion is shown to be insufficient. A dynamic analysis relates crash pulse criterion to restraint system deflection, leading to load limiting type energy absorber concepts. An effectiveness analysis is given of existing Army cargo restraint methods as presently employed, the same methods applied in a correct manner, and the proposed restraint system properly applied. Author (TAB)

N67-20620# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
A COURSE IN AIRCRAFT DESIGN
M. N. Shul'zhenko and A. S. Mostovoy 21 Sep. 1966 558 p refs Transl. into ENGLISH of the book "Kurs Konstruktsiy Samoletov" Moscow, Izd. Mashinostroyeniye, 1965 p 1–563
(FTD-MT-66-32; TT-67-60334; AD-643921) CFSTI: HC $3.00/MF $0.65

This text was prepared for use by students in aeronautical technical schools specializing in aircraft construction and consists of the following major headings: fundamentals of aircraft structural mechanics; aircraft design fundamentals; and design and strength analysis of aircraft assemblies. TAB

N67-20706# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
FLIGHT DYNAMICS (AIRCRAFT TRAJECTORIES)
I. V. Ostoslavskiy and I. V. Strazheva 19 May 1966 673 p refs Transl. into ENGLISH of the book "Dinamika Poleta, Trayektorii Letatel'nykh Apparatov" Moscow, Oborongiz, 1963 430 p
(FTD-HT-66-243; TT-67-60326; AD-644141) CFSTI: HC $3.00/MF $0.65

The book introduces methods for calculating the flight trajectory of different types of aircraft: airplanes, guided airplane-rockets, ballistic rockets and rocket planes. Methods of optimization of flight trajectories based on the application of variational calculus are examined. Brief reports of the application of mathematical devices in problems of flight dynamics are introduced. Author (TAB)

N67-20708# ARO, Inc., Arnold Air Force Station, Tenn.
ON THE RELATIVE IMPORTANCE OF THE LOW SPEED CONTROL REQUIREMENT FOR V/STOL AIRCRAFT Technical Report, Dec. 1965–Sep. 1966
Stephen Goldberger Arnold Eng. Develop. Center, Dec. 1966 30 p refs
(Contract AF 40(600)-1200)
(AEDC-TR-66-205; AD-644191) CFSTI: HC $3.00/MF $0.65

The closed loop dynamic response of a V/STOL airplane, pilot, and autostabilization system was studied with the purpose of demonstrating which airplane parameters are most important in determining the airplanes low speed flight characteristics. The influence of the stability augmentation system was found to be so great that the other parameters are small by comparison. The most important stability and control parameter in low speed, V/STOL aircraft flight, therefore, is control power. Author (TAB)

N67-20886# Industrial Nucleonics Corp., Columbus, Ohio.
HELICOPTER CLOSE-ORDER FORMATION KEEPING SYSTEM Final Report
Linus K. Hahn, Charles E. Krause, and Orval L. Utt, Jr. 11 Aug. 1966 110 p refs
(Contract AT(11-1)-1471)
(COO-1471-7) CFSTI: HC $3.00/MF $0.65

An isotopic gamma-ray signaling system to permit close-order formation keeping in helicopters within a range of from 50 to 500 feet is described. A successful ground demonstration of the Helicopter Formation Keeping System was performed. The system concept uses a modulated gamma-ray source and fixed gamma-ray detector array on each helicopter. The feasibility demonstration proved that a fixed gamma-ray detector array can differentiate between signals from two modulated gamma-ray sources. The signals were processed to provide a display similar to a PPI-type display. The display indicated the proper bearing and spacing between the two sources and the detector array. Phase II has been authorized to develop and demonstrate a flight model of the system with Navy participation through the Atomic Energy Commission. Author (NSA)

N67-21187# Aeronautical Research Council (Gt. Brit.)
MEASUREMENTS OF THE ROLLING RESPONSE OF A FIGHTER AEROPLANE (HUNTER Mk.6) TO TURBULENT AIR AND A COMPARISON WITH THEORY
J. Burnham 1966 12 p refs Supersedes RAE-TR-65033; ARC-26996; See X65-18342
(ARC-CP-898; RAE-TR-65033; ARC-26996) CFSTI: HC $3.00/MF $0.65

Measurememts of rate of roll and aileron deflections have been made during the landing approach, in turbulent air. These have been used to compute spectral densities of the rate of roll which would have occurred with the ailerons fixed. The results show good agreement with comparable spectra which were calculated theoretically. Author

N67-21192 Aeronautical Research Council (Gt. Brit.)
INTERIM REPORT ON LOW-SPEED FLIGHT TESTS OF A SLENDER-WING RESEARCH AIRCRAFT (HANDLEY PAGE H.P. 115)
P. L. Bisgood and C. O. O'Leary 1966 51 p refs Supersedes RAE-TN-AERO-2021; ARC-25663; See X66-82176
(ARC-CP-838; RAE-TN-AERO-2921; ARC-25663) CFSTI: HC $3.00

Tests forming part of a comprehensive programme of lateral stability measurements are described and their results discussed, together with miscellaneous supporting tests. The stability derivatives with respect to aileron deflection (l_{ξ}, n_{ξ}) and sideslip (l_v, n_v, y_v) have been measured by static methods, the rudder derivatives (l_ρ, n_ρ, y_ρ) have been deduced from the transient response to rubber pulses, and the derivatives l_v, l_p, n_v, n_r, y_v and y_p have been obtained from time-vector analysis of the dutch-roll mode. Where possible, these results are compared with wind-tunnel tests; the agreement is satisfactory in the case of the aileron and sideslip derivatives measured under static conditions, and l_v and n_v obtained from dutch-roll analysis agree well with the 'static' results. A brief report on the more important handling qualities is included. Contrary to expectation, the handling of the aircraft is free from serious problems. Author

N67-21195# Aeronautical Research Council (Gt. Brit.)
A REVIEW OF INFORMATION ON THE FREQUENCY OF GUSTS OF LOW ALTITUDE
N. I. Bullen 1966 18 p refs Supersedes RAE-TR-65141; ARC-27281; See X66-10470
(ARC-CP-873; RAE-TR-65141; ARC-27281) CFSTI: HC $3.00/MF $0.65

The paper reviews information from several sources on atmospheric gusts at altitudes below 1000 feet. Comparison is made between gust statistics obtained from passenger transport aircraft and those acquired during special investigations. The information gives reliable average figures for passenger transport

operations but, owing to the wide variation of gust frequencies under different conditions, it is concluded that for military aircraft flying at low level, a more detailed knowledge of operating conditions is necessary for reliable estimates of gust frequencies to be made. Author

N67-21198# Aeronautical Research Council (Gt. Brit.)
COMPARISON OF HELICOPTER AND AEROPLANE VERTICAL ACCELERATIONS IN TURBULENCE
D. A. Webber 1966 32 p refs Supersedes RAE-TR-65190; ARC-27417; See X66-11788
(ARC-CP-878; RAE-TR-65190; ARC-27417) CFSTI: HC $3.00/MF $0.65

Counts of acceleration increments were recorded in a helicopter and an aeroplane flying through the same weather. The accelerations were compared and values for the gust alleviation factor for the helicopter were deduced. It is shown that these values increase with forward speed and at the highest forward speed attained are in reasonable agreement with the American MIL-S-8698 requirements. Author

N67-21418 National Aerospace Lab., Tokyo (Japan).
EXPERIMENTAL STUDY ON THE GROUND EFFECT OF A MODEL HELICOPTER ROTOR IN HOVERING
Jiro Koo and Toichi Oka 1966 19 p refs *In* JAPANESE; ENGLISH summary
(NAL-TR-113) CFSTI: $3.00

Aerodynamic characteristics of a model helicopter rotor hovering in the ground effect have been experimentally investigated. Two kinds of experiments—measurements of the thrust, torque and induced velocity of the hovering rotor in the ground effect, and flow visualizations around the hovering rotor in the ground effect by the use of tuft—were conducted. The qualitative results obtained are as follows. (1) When a hovering rotor in higher pitch angle gets near to the ground, there is a saturation in the thrust increase from the ground effect according to the blade stall. If a rotor is operated in lower pitch angle, the torque for the constant revolution increases gradually with the approach to the ground; however, in the next stage it begins to decrease by up-wash which makes the lift vector incline forward. (2) It appears from flow observations that the periodical fluctuation of interference flow between down-wash and up-wash may introduce the unsteady phenomena of a hovering helicopter in the ground effect. Author

N67-21454* National Aeronautics and Space Administration, Washington, D. C.
FLIGHT TESTING OF AIRCRAFT
Mikhail Grigor'yevich Kotik, Aleksey Vasil'yevich Pavlov, Igor Mikhaylovich Pashkovskiy, Yuriy Sergeyvich Sardanovskiy, and Nickolay Grigor'yevich Shchitayev Apr. 1967 404 p refs Transl. into ENGLISH of the book "Letnyye Ispytaniya Samoletov" (Moscow), Izd. Mashinostr., 1965
(NASA-TT-F-442) CFSTI: $3.00 CSCL 01C

This book describes modern methods for aircraft flight tests. Emphasis is on the presentation of the theoretical principles for determining all basic characteristics of a modern aircraft and the methods for carrying out flight experiments and processing flight records. Possible measurements errors and ways for taking them into account are considered for aircraft flight tests. The book is a study-aid for students at aviation technical schools in the course on aircraft flight tests and may also be used as a systematic reference by a wide range of specialists at flight test stations of aircraft construction plants. Author

N67-21741# Royal Aircraft Establishment, Farnborough (England).
A METHOD OF INVESTIGATING THE DEPLOYMENT CHARACTERISTICS OF MAN-CARRYING PARACHUTES
A. G. Jolly Aug. 1966 16 p ref
(RAE-TR-66280) CFSTI: HC $3.00/MF $0.65

Test releases of man-carrying parachutes from balloons, or aircraft do not permit of any detailed examination of the processes of withdrawing the rigging lines and canopy from the pack (i.e. deployment). Irregularities during this phase may cause malfunctions to develop during opening. The method of test described permits examination of the deployment from the parachute pack and reveals information lacking in flight tests. It is proposed that this test method may be used to investigate the behavior of new, or modified parachute systems. Author

N67-21877# LTV Aerospace Corp., Dallas, Tex. LTV Vought Aeronautics Div.
INVESTIGATION OF CONTACTLESS SWITCHING CONCEPTS FOR APPLICATIONS TO AIRCRAFT ELECTRIC SYSTEMS. VOLUME VII. DEVELOPMENT AND EVALUATION OF CHECKOUT CONCEPTS FOR A CONTACTLESS SWITCHING SYSTEM
H. S. Bates Dec. 1966 61 p
(NOw-65-0397-c)
(Rept.-2-51727/75-449-7; AD-645428) CFSTI: HC $3.00/MF $0.65

A development program was conducted to establish requirements and evaluate techniques for checkout of a contactless switching system. The program included investigations to establish requirements; design studies to develop concepts or techniques to fulfill these requirements; and breadboard evaluations to demonstrate these checkout techniques. Author (TAB)

03 AUXILIARY SYSTEMS

Includes fuel cells, energy conversion cells, and solar cells; auxiliary gas turbines; hydraulic, pneumatic and electrical systems; actuators; and inverters. For related information see also: 09 Electronic Equipment; 22 Nuclear Engineering; and 28 Propulsion Systems.

N67-20394 Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ANALYSIS OF SPECTRAL AND TEMPERATURE CHARACTERISTICS OF PHOTOELECTRIC TRANSDUCERS AND SELECTION OF EFFICIENT RANGES FOR THEIR APPLICATION
M. B. Kagan, A. P. Landsman, and Ya. I. Chernov *In its* Cosmic Res. 23 Jun. 1966 p 205–219 refs (See N67-20381 10-30) CFSTI: $3.00

It is shown on the basis of consideration of the spectral sensitivity and the collection process of the pairs generated by light in GaAs photoelectric transducers that the specific trend of the absorption coefficient as a function of wavelength opens the possibility of producing highly efficient GaAs transducers with a thin base layer and short diffusion lengths. It is shown that photoelectric transducers based on GaAs–GaP possess higher sensitivity in the short wave part of the spectrum than Si- or GaAs phototransducers. On the basis of the temperature characteristics of Si, GaAs and GaAs–GaP transducers, effective ranges of their application are derived. Author

N67-20549# Naval Ordnance Lab., White Oak, Md. Chemistry Research Dept.
BATTERY SEPARATOR MECHANISMS Literature Survey Report

Charles F. Mc Clure 26 Sep. 1966 48 p refs
(NOLTR-64-136; AD-642779) CFSTI: HC $3.00/MF $0.65

In order to improve the characteristics of batteries, an understanding of battery separators and how they can inhibit the motion of ions and molecules is desired. This report reviews some of the theories invented to explain the transport of material through solutions and barriers. Author (TAB)

N67-20593# Avco-Everett Research Lab., Everett, Mass.
PRODUCTION OF HIGH ENERGY ELECTRICAL IMPULSES WITH AN MHD GENERATOR Quarterly Technical Summary Report, 1 May–31 Jul. 1966
Aug. 1966 13 p
(Contract AF 33(615)-2846)
(AD-641019) CFSTI: HC $3.00/MF $0.65

The period covered by the report was devoted to systems and components testing, burner testing, generator excitation testing, as well as a complete configuration single circuit power test. The resulting data from the excitation and power output tests indicates close agreement with the design parameters. The single circuit power test was terminated at a magnet current of approximately 15,000 amperes and resulted in a maximum net power output of 11,000 kilowatts. During this period some problems were encountered, mainly with the older equipment, which required revisions to such items as pilot and igniter fuel systems, pilot cooling and the main fuel-nitrogen purge systems. Section II describes modification to the igniter and pilot burners and to the channel inlet section, as well as the results of the complete configuration tests. Author (TAB)

N67-20611# Naval Ordnance Labs., Corona, Calif.
WALLEYE FUZE MK 328 MOD 0 EXPLOSIVE-TRAIN TESTS
Richard L. Higuera and Rex L. Smith 25 Jul. 1966 33 p refs
(NOLC-871; AD-637002) CFSTI: HC $3.00/MF $0.65

The report describes the tests performed to verify the safety of the mk 328 mod 0 fuze explosive train the safe and commit-to-arm positions and those performed to determine the reliability of the explosive train in the army position. The safety was verified by firing and analyzing 94 shots using detonators with high outputs, leads with varying sensitivities, and barriers with reduced thicknesses. The reliability was determined by Bruceton analysis of 98 firings in which varicomp explosives and methods were used. Author (TAB)

N67-20678# Naval Research Lab., Washington, D. C.
THE PLATE MATERIALS OF THE LEAD-ACID CELL. PART 2: ANODIC OXIDATION OF $PbSo_4$, $Pb_3 So_4$, $2PbCo_3$; $Pb(OH)_2$, AND ORTHORHOMBIC PbO
Jeanne Burbank 7 Oct. 1966 21 p refs
(NRL-6450; AD-644599) CFSTI: HC $3.00/MF $0.65

Four compounds commonly present in the active material pastes of the lead-acid cell (PbSO4, Pb3O4, 2PbCO3 . Pb(OH)2, and orthorhombic PbO) were individually oxidized anodically in dilute sulfuric acid. X-ray diffraction showed that each transformed to beta PbO2. The anodic products were examined in the electron microscope directly and by means of carbon replicas. Lead sulfate and 2PbCO3 . Pb(OH)2 formed primarily complex dendritic crystals of PbO2; Pb3O4 gave rise to clusters of prismatic tabular crystals and nondescript nodules; and orthorhombic PbO was transformed to agglomerates of nondescript particles showing no evidence of prismatic dendritic crystallization. These forms of crystallization are compared with those observed in commercial battery plates including lead-calcium cells giving satisfactory and unsatisfactory float performance. The morphologies of the PbO2 particles resulting from the electrochemical transformations depended upon the source material, and their probable growth mechanisms are discussed. Author (TAB)

N67-20688# Air Force Systems Command, Wright-Patterson AFB, Ohio. Air Force Aero Propulsion Lab.
EXPERIMENTAL EVALUATION OF MHD GENERATORS OPERATING AT HIGH HALL COEFFICIENTS
Robert R. Barthelemy, Brian G. Stephan, and Robert F. Cooper [1966] 8 p Presented at the Intern. Symp. on Magnetohydrodyn. Power Generation, Salzburg, Austria, 4–8 Jul. 1966
(AFAPL-CONF-67-1; SM-74/166; AD-643831) CFSTI: HC $3.00/MF $0.65

A flexible, combustion-driven, MHD-generator test facility is being constructed to allow investigations of various generator operating parameters, generator configurations and designs, and component materials. The plasma source is a combustion chamber in which toluene or another suitable fuel is burned with gaseous oxygen diluted with nitrogen. Potassium hydroxide seed is injected with the fuel to produce the necessary plasma conductivity. The gas stream is accelerated in a supersonic nozzle and then flows through the Hall channel. The channel is constructed of water-cooled, Inconel rings suitably grooved for the zirconia electrode material. The magnet is an iron-core design with coils wound of hollow conductor to permit water cooling for high-power operation. The magnet has the capability of operating at field strengths to 23,000 gauss. Operation of the generator at a gas mass flow of 1.5 pounds per second, seed concentration of 0.2 mole percent potassium, channel static temperature of 2200K and pressure of 0.28 atmospheres, field strength of 15 kilogauss, Mach number of 2.5, and a Hall coefficient of 3.4 will be investigated initially. Author (TAB)

N67-20710# Naval Research Lab., Washington, D. C.
MICROGRAPHY OF TUBULAR-TYPE BATTERY PLATES
A. C. Simon 3 Oct. 1966 29 p
(NRL-6428; AD-643750) CFSTI: HC $3.00/MF $0.65

Tubular type battery plates of various stages of production were obtained from three battery manufacturers and examined microscopically. It was ascertained that certain physical changes took place in the microstructure of the material after soaking in acid and after forming. These changes were not the same as those that occurred when plates were prepared from mixed and cured paste and subsequently formed. To all visible appearances the product from the tubular plate appeared to have cohesion and porosity equal to or better than from most pasted plates. However, the adherence of the paste to the metal spline was poor. Of particular interest was the discovery that the formed active material of one of these manufacturers contained a definite reticulate structure such as had previously been found to coexist with plates that successfully floated without loss of capacity. Author (TAB)

N67-20749# Aeronutronic, Newport Beach, Calif.
ORGANIC RANKINE CYCLE FEASIBILITY DEMONSTRATION PROGRAM Quarterly Report, 30 Jun.–30 Sep. 1966
G. Baenteli 10 Oct. 1966 26 p
(Contract AT(04-3)-650)
(SAN-650-2; QR-2; U-3789) CFSTI: HC $3.00/MF $0.65

An evaluation of monoisopropylbiphenyl as the working fluid in a Rankine cycle will be made in simulated power conversion loops. The status of the 1000-hr endurance loop development, the test facility, the instrumentation, and the data acquisition system are discussed. NSA

N67-20780# California Univ., Livermore. Lawrence Radiation Lab.
MODULAR DESIGN 300-Kw DC POWER SUPPLY SYSTEM
Glen D. Polzin and G. Gordon North 23 Sep. 1966 13 p Presented at the Symp. on Eng. Probl. of Controlled Thermonucl. Res., Gatlinburg, Tenn., 3–6 Oct. 1966 Submitted for publication
(Contract W-7405-ENG-48)
(UCRL-70017; CONF-661016-11) CFSTI: HC $3.00/MF $0.65

The power supply system was designed in two units of modular construction. One, the rectifier unit, was water cooled and built for zero side clearance installation. Thus, it is quiet enough and sufficiently compact to permit installation close to the experiment to hold low voltage dc busing to a minimum. The other, an ac power controller unit, was built for installation near the source of power, preferably adjacent to the substation switchgear. Control was accomplished with a servo-driven induction voltage regulator. A selector switch commands either voltage regulation to ±0.15% or current regulation to ±0.3%. All low-current circuitry is plug interconnected to simplify moves. A removable control panel is incorporated into the design to facilitate remote operation. Many other convenience and safety features are incorporated. The modular design also permits the use of the rectifier unit without the controller unit when on-off control is satisfactory. A number of unregulated rectifier units may also be inserted in series with a regulated system to increase voltage compliance where necessary. This combination gives limited regulation range at much higher powers and at reduced equipment costs. The first year of operating experience with these systems has been highly satisfactory.
Author (NSA)

N67-21133# Techne, Ltd., Cambridge (England). Fluidics Div.
THE APPLICATION OF SPRING CONTROLLED NOR UNITS TO MACHINE SWITCHING OPERATIONS
G. M. Brewin 5 Jan. 1967 12 p refs Presented at the 2d Cranfield Fluidics Conf., Cambridge, Engl., 3–5 Jan. 1967
(J2) CFSTI: HC $3.00/MF $0.65

The switching of a sequence of machine operations and the interlocking of machine controls can be readily achieved using spring controlled pneumatic switching units supplied by suitable signal generating devices. In most cases there is a considerable saving in the cost of the control system in comparison with conventional electrical methods of control. The development of these devices is described and applications to machine control discussed.
Author

N67-21134# Hymatic Engineering Co., Ltd., Redditch (England).
PERFORMANCE OF A COANDA DEVICE AS A PRESSURE MAINTAINER AND AS A SWITCH OR SELECTOR
R. R. Hart 5 Jan. 1967 15 p refs Presented at the 2d Cranfield Fluidics Conf., Cambridge, Engl., 3–5 Jan. 1967
(B4) CFSTI: HC $3.00/MF $0.65

The performance of a Coanda or turbulent reattachment device used in two ways, with air as the working fluid, is outlined. The use of a Coanda device as a pressure maintainer is discussed. Two devices are mentioned, one where a datum pressure is used in one control port and the other where an angled main jet is used to provide the reference. One outlet from the device is connected to the system while the other is open to atmosphere. The system pressure is also connected to a control jet, hence completing the control loop. The performance of these units has not been fully evaluated but the initial results have shown that the system pressure can be maintained within 5 lbf/sq in for a system flow variation from zero to 3 cu ft/min and inlet pressures up to at least 60 lbf/sq in. The performance of a Coanda device as a switch or selector is also reviewed. The maximum outlet pressure is limited to approximately 8 lbf/sq in gauge being 60% of the jet velocity head. A method of obtaining higher pressures is to fit a vortex chamber to the Coanda outlets, such that one enters radially and the other tangentially. Using this arrangement outlet pressures of 30 lbf/sq in gauge have been obtained with inlet pressures of 60 lbf/sq in gauge.
Author

N67-21136# International Computers and Tabulators, Ltd., London (England).
STEADY-STATE AND DYNAMIC CHARACTERISTIC VARIATIONS IN DIGITAL WALL-ATTACHMENT DEVICES
B. J. Steptoe 5 Jan. 1967 12 p refs Presented at the 2d Cranfield Fluidics Conf., Cambridge, Engl., 3–5 Jan. 1967 Supported by the Min. of Technol.
(B6) CFSTI: HC $3.00/MF $0.65

Steady state tests on miniature OR/NOR and bistable wall-attachment elements are described. Results are given in the form of histograms of input and output pressure characteristics for batches of elements manufactured by the epoxy replication process. Power flow variations are also described. Switching characteristics of the OR/NOR elements are described and differences between switch on and switch off delay are mentioned. An attempt is made to compare steady state and switching characteristics. A discussion of noise immunity is given, and specifications for elements are derived. It is concluded that epoxy replication is one method of achieving the close control of characteristics required for successful manufacture of fluidic integrated circuits.
Author

N67-21137# Technical Univ. of Prague (Czechoslovakia). Faculty of Mechanical Engineering.
OPTIMAL DESIGN OF THE CONTROL JET OF A FLUID AMPLIFIER
Pavel Drazan 5 Jan. 1967 8 p Presented at the 2d Cranfield Fluidics Conf., Cambridge, Engl., 3–5 Jan. 1967
(B2) CFSTI: HC $3.00/MF $0.65

A method of optimal design of the pneumatic amplifier control jet to obtain the maximum logic gain of the amplifier connected to a logic circuit is discussed. A graphical method is given for checking the predictions.
Author

N67-21138 Royal Military Coll. of Science, Shrivenham (England). Branch of Engineering Physics.
EXPERIMENTS USING THE MOMENTUM INTERACTION PRINCIPLE TO PRODUCE A PROPORTIONAL FLUID AMPLIFIER
C. M. Carne 5 Jan. 1967 16 p refs Presented at the 2d Cranfield Fluidics Conf., Cambridge, Engl., 3–5 Jan. 1967
(C1) CFSTI: $3.00

A study of the geometry and characteristics of a proportional fluid amplifier operating on the principle of momentum interaction is made, in order that it may fulfil a specific application within the field of control system engineering. Two approaches to the problem are made; the first, a trial and error method of optimizing the amplifier conditions, the second a study of the jet behavior to determine the optimal conditions. A comparison between the relative merits of these two methods is given. All experimental work has been carried out on models of the element form and the method of converting model data to form a practical fluidic element is shown.
Author

N67-21139 College of Aeronautics, Cranfield (England). Dept. of Production and Industrial Administration.
THE DESIGN OF A PURE FLUID SHAFT ENCODER
S. Ramanathan, I. Aviv, and R. E. Bidgood 5 Jan. 1967 26 p refs Presented at the 2nd Cranfield Fluidics Conf., Cambridge, Engl., 3–5 Jan. 1967 Sponsored by the Sci. Res. Council
(E4) CFSTI: $3.00

The design and construction of a pure fluid digital shaft encoder are discussed. The encoder has been designed for application to a machine tool slideway reading linear position in increments of 0.001 in. to a total length of 10 in. Details are given of input conditions, output conditions, maximum readout frequency and comparison with other methods of shaft encoding.
Author

N67-21163* Allis-Chalmers Mfg. Co., Milwaukee, Wis. Research Div.
REACTANT CONTROL AND CONDITIONING SUBSYSTEM—DEVELOPMENT PLAN ACTIVITY 190

Paul D. Hess 20 Nov. 1964 7 p
(Contract NAS8-2696)
(NASA-CR-83116; TM-00067) CFSTI: HC $3.00 CSCL 10C

Development and test programs are outlined for the reactant control and conditioning subsystem (RCCS), which is an electromechanical assembly designed to supply reactant flow rates automatically as required by an electrical load demand on the fuel cell module. Other functions of the RCCS are stated to be capable of thermally conditioning the reactants and regulating reactant gas pressure, and providing means of periodically purging the buildup of inerts within the cell. The components comprising the RCCS are mentioned, and component development requirements are discussed. In-house development will be primarily concerned with work on the reactant vent provision, the exhaust solenoid valve configuration, and alternate purge modes that may be necessary with the present plate manifolding and electrode designs. L.E.W.

N67-21173*# TRW Systems, Redondo Beach, Calif.
POWER SYSTEM CONFIGURATION STUDY AND RELIABILITY ANALYSIS Second Quarterly Progress Report, 7 Oct. 1966–6 Jan. 1967
W. G. Binckley 6 Jan. 1967 22 p Prepared for JPL
(Contract NAS7-100)
(NASA-CR-83120; E-7061.2-299) CFSTI: HC $3.00/MF $0.65 CSCL 10B

Investigations leading to the development of photovoltaic power system design optimization data and procedures for five interplanetary missions are described. Candidate baseline power system configurations are summarized. System reliability analyses and procedures for selecting optimum configurations are discussed. Author

N67-21391*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
THE PERFORMANCE OF N/P SILICON AND CdS SOLAR CELLS AS EFFECTED BY SIMULATED MICROMETEOROID EXPOSURE
M. J. Mirtich and R. L. Bowman Washington, NASA, 1967 14 p refs Presented at the 6th IEEE Photovoltaic Specialists Conf., Cocoa Beach, Fla., 28–30 Mar. 1967
(NASA-TM-X-52273) CFSTI: HC $3.00/MF $0.65 CSCL 10A

Degradation of protected and unprotected solar cells bombarded by simulated micrometeoroids was studied. Degradation was determined by measuring the current-voltage characteristics of the cells both before and after exposure to particle clouds. To relate laboratory degradation of cell performance to that obtained in space for comparison with actual satellite data, a conversion of laboratory exposure in joules to actual time in space was required. Only N/P silicon solar cells were compared since CdS solar cells have not been tested in space. Major conclusions were that micrometeoroid damage to N/P silicon solar cells covered by the thinnest glass sheets that were used (6 mils) was greatly reduced from the damage obtained from cells without cover plates. A mylar encapsulated CdS solar cell will perform in a micrometeoroid environment as well as a N/P silicon solar cell protected by a 6 mil cover sheet. Conclusions drawn from a comparison of laboratory results with Relay I and II results depend heavily on the micrometeoroid flux distribution chosen as representative of the micrometeoroid environment. The study suggests that protection of solar cells from micrometeoroid damage may be as important as protection against radiation damage. S.P.

N67-21398*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SOME RELIABILITY EFFICIENCY ASPECTS OF LOW INPUT VOLTAGE INVERSION/CONVERSION FROM RADIOISOTOPIC THERMOELECTRIC GENERATOR POWER SOURCES
Edward R. Pasciutti Feb. 1967 38 p refs
(NASA-TM-X-55727; X-716-67-110) CFSTI: HC $3.00/MF $0.65 CSCL 10B

Solutions obtained to some of the component and circuit problems investigated in the area of low-input-voltage conversion and regulation from radioisotopic thermoelectric generator (RTG) sources are presented. The overload handling capability of the current feedback (IFB) driven inverter allows implementation of a functionally-integrated RTG source/IFB inverter protection technique for use with the inherenty power-limited RTG sources. The method results in a reduction of size and weight and of heat rejection radiator requirements. High reliability and high power levels can be obtained by the use of multiple-source/multiple-converter module parallel combined configurations. Continued reduced level operation is enabled in the event of degraded source power output or of component failure. Two synchronized parallel combined voltage step-up converters designed for use with SNAP-19 RTG sources demonstrate the functionally-integrated source conversion protection technique developed. Circuit simplicity is achieved and reliable source/converter protection for all output loading conditions automatically established. Author

N67-21442*# Whittaker Corp., San Diego, Calif. Narmco Research and Development Div.
ELECTROCHEMICAL CHARACTERIZATION OF SYSTEMS FOR SECONDARY BATTERY APPLICATION Quarterly Report, Nov. 1966–Jan. 1967
M. Shaw, A. H. Remanick, and R. J. Radkey 17 Feb. 1967 97 p refs
(Contract NAS3-8509)
(NASA-CR-72181; QR-3) CFSTI: HC $3.00/MF $0.65 CSCL 10A

Multisweep cyclic voltammograms have been obtained for an additional one hundred and ninety-three systems comprising silver, copper, nickel, cobalt, as well as the oxides and fluorides of these metals, in acetonitrile, butyrolactone, dimethylformamide, and propylene carbonate solutions of chlorides, perchlorates, and fluorides. Voltammograms are presented for thirty-nine of these systems. Tabular data includes peak current density, sweep index, charge-discharge efficiency, and cathode compatibility. Author

N67-21448*# Manson (S. V.) and Co., Inc., Arlington, Va.
AN EXPLORATORY STUDY OF INTERNALLY AND EXTERNALLY FINNED RADIATORS FOR BRAYTON CYCLES IN SPACE
S. V. Manson Washington, NASA, Mar. 1967 130 p refs
(Contract NAS3-2535)
(NASA-CR-615) CFSTI: HC $3.00/MF $0.65 CSCL 10B

A preliminary study has been made of Brayton cycle radiators that use a gas as their working fluid. The radiators have been assumed to be assemblies of armored, externally finned tubes that lie in one plane and radiate heat to both sides of the plane. The radiator operating conditions that have been assumed correspond to a solar-powered Brayton cycle that uses argon as working fluid and delivers 10 kilowatts of electrical power steadily during a 365 day mission, in an environment in which protection against meteoroids is a substantial requirement. Numerical results demonstrated that there exist optimum values for the independent geometric variables of the radiator, namely, tube length, tube inside diameter, number of internal fins per tube for each species of internal fin geometry, and number of branches into which the headers are split. It was also indicated that an optimum value exists for the conductance parameter of the external fins, and that the optimum value is affected by the diameter of the tube. Author

N67-21611# Sundstrand Corp., Rockford, Ill. Aviation Div.
ORGANIC RANKINE CYCLE TECHNOLOGY PROGRAM Quarterly Progress Report, 1 Jul.–1 Oct. 1966

A. Warren Adam 1 Oct. 1966 52 p
(Contract AT(04-31)-651)
(SAN-651-8; AER-462; QPR-2) CFSTI: HC$3.00/MF$0.65

A research program is being conducted to develop an organic Rankine cycle power conversion system for long-time operation in space. The working fluids to be evaluated are biphenyl and biphenyl–biphenyl ether eutectic. The program includes working-fluid, bearing, condensate-pump, and boiler investigations. Calculations on hydrogen diffusion in the test loops and progress on equipment for the investigations are discussed. NSA

N67-21614# Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.
CONTRIBUTION TO THE STUDY OF A NEW IONIZING-ENERGY CONVERSION EFFECT IN ELECTRICITY [CONTRIBUTION A L'ETUDE SUR UN NOUVEL EFFET DE CONVERSION D'ENERGIE IONISANTE EN ELECTRICITE]
Mohammad Rahim Ahrabi (Ph.D. Thesis—Paris Univ.) 1966 63 p refs In FRENCH
(CEA-R-2974)

When two identical electrodes at different temperatures are placed in a vapor or in a condensible ionized gas, an electromotive force is produced between the two electrodes. The potential differences obtained are too great to be attributed merely to a thermocouple effect, and the electromotive forces observed are of a quite different order of magnitude from those obtained theoretically using conventional hypotheses. Author (NSA)

04 BIOSCIENCES

Includes aerospace medicine, exobiology, radiation effects on biological systems; physiological and psychological factors. For related information see also: 05 Biotechnology.

N67-20397 Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
RESULTS OF PREFLIGHT AND POSTFLIGHT MEDICAL EXAMINATION OF CREW MEMBERS OF THE VOSKHOD SPACECRAFT
P. V. Buyanov, V. V. Kovalev, V. G. Terent'yev, Ye. A. Fedorov, and G. F. Khlebnikov *In its* Cosmic Res. 23 Jun. 1966 p 245–253 (See N67-20381 10-30) CFSTI: $3.00

Results of postflight clinical and physiological data obtained on crew members of the Voskhod spacecraft are compared with preflight data and data obtained during spacecraft simulator tests. Postflight examinations indicated a moderate decrease in ability to work, slight instability in Romberg's position, tremors of the fingers, higher-than-normal perspiration, a moderate decrease in muscle tone, quickening of the pulse, and a decrease in pulse pressure due to an increase in the diastolic pressure. Body weight had declined by 2.5–4%. There were also moderate shifts in metabolic processes, manifested in an increase in the basal metabolism, cholesterol level, blood urea and excretion of nitrogeneous components with the urine. The phagocytic activity of the leucocytes had decreased to some degree. The changes observed after the flight were associated with fatigue effects and the stress reaction. The deviations noted were functional in nature and vanished a few days after the flight. The differences detected in the nature of the changes were associated with individual peculiarities and the quality of preflight preparation. Author

N67-20398 Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
INFLUENCE OF FACTORS IN SPACEFLIGHT ABOARD THE "VOSKHOD" MANNED SPACECRAFT ON TRADESCANTIA PALUDOSA MICROSPORES
N. L. Delone, B. B. Yegorov, and V. V. Antipov *In its* Cosmic Res. 23 Jun. 1966 p 254–262 refs (See N67-20381 10-30) CFSTI: $3.00

The sensitivity of developmental phases in *Tradescantia paludosa* microspores to Voskhod spaceflight conditions (ascent, weightlessness, and landing) was studied on the basis of the following sensitivity criteria: chromosome rearrangements, and disturbances in cellular mitosis. The objective of the study was to determine the validity of the projected hypothesis that chromosome rearrangements are caused by a single group of factors accompanying manned spaceflight, and disturbances in cellular mitosis are caused by another group of factors. The sensitivity of phases in *Tradescantia paludosa* was found to vary. The late and middle prophase were found to be most sensitive; thereafter, sensitivity diminished and the early interphase was found to be the least sensitive. When the number of cells with mitotic disturbances was taken as the sensitivity criterion, the late interface was the most sensitive and sensitivity was lower in the prophase and lowest in the early interphase. S.C.W.

N67-20403 Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
BIOLOGICAL-EFFECT SIMULATION OF MONOENERGETIC PROTON-FLUX DEPTH DOSE
V. S. Morozov, V. S. Shaskov, and B. I. Davydov *In its* Cosmic Res. 23 Jun. 1966 p 284–289 refs (See N67-20381 10-30) CFSTI: $3.00

Using mice as models of the biological cell of the living organism, experiments were performed in an attempt to evaluate the change in biological effectiveness of proton penetration near the end of its path, and the biological effect of irradiation in specific regions of the organism. Two groups of animals were used, one of which was given an intraperitoneal dose of 150 mg/kg of a radioprotective substance (AET) 15 to 20 minutes before irradiation; the other of which was given a dose of 1600 rad at a dose rate of 50 rad/min in a synchrocyclotron. Data on survival rates and average survival time of animals irradiated in the synchrocyclotron and animals given the AET are compared. Results indicate that physical protection may be a factor that intensifies the effect of cosmic radiation of solar origin, radiation belts of the earth, and the effectiveness of using pharmacochemical protective agents. S.C.W.

N67-20420*# Aerojet-General Corp., Azusa, Calif. Life Support Systems Div.
BIOLOGICAL EXPLOITATION OF A PLANET
B. J. Mechalas, R. P. Geckler, and B. D. Culver *In* NASA 2d Ann. Meeting of the Working Group on Extraterrest. Resources [1964] p 84–88 refs (See N67-20412 10-30) CFSTI: HC $3.00/MF$0.65

Various aspects of converting planetary resources to make a suitable environment for human colonization are considered. The use of earth microorganisms would be the simplest way, and one requiring the least input of energy, to convert the reducing environment of a planet to an oxidizing one. The competitive effects of these organisms on an existing ecological system are discussed. The roles of heterotrophic anerobes, photosynthetic autotrophs, purple sulfur bacteria, and blue green algae in altering an alien environment are described. Also mentioned is the need for spacecraft sterilization as well as studies to determine characteristics of alien microorganisms and the survivability of earth organisms on other planets. R.N.A.

N67-20444# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
PHYSIOLOGICAL METHODS IN ASTRONAUTICS

R. M. Bayevskiy 16 Aug. 1966 303 p refs Transl. into ENGLISH of the book "Fiziologiya Cheloveka i Zhivotnykh" Moscow, Izd. "Nauka", 1965 p 1–299
CFSTI: HC $3.00/MF $0.65

Contents: Brief historical outline of physiological space research; transmission of physiological information from spacecraft to earth; contemporary physiological measurement systems on spacecraft; design principles of physiological measurement and information systems for use on long-term, long-range space flights; on-board automatic physiological information processing systems; some problems of physiological measurement in interplanetary flights; cardiovascular research methods; research on the external respiratory function; methods for studying the neuromuscular system and working capacity; methods for studying the vestibular apparatus; future trends in the development of physiological research in astronautics.

N67-20499# Georgia Univ., Athens.
PSYCHOPHYSIOLOGIC VARIABLES AS INDICATIONS OF EMOTIONAL STRESS Final Report, Apr. 1964–Jul. 1965
Herbert Zimmer Griffiss AFB, N. Y., RADC, Sep. 1966 622 p refs
(Contract AF 30(602)-3380)
(RADC-TR-65-298; AD-641814) CFSTI: HC $3.00/MF $0.65

The report covers the physiological responses of the human and means of achieving maximum discrimination between critical and neutral stimuli. Consideration is given to the social context in which the response is solicitated, the selection of the most useful psychophysiologic variable, methods of recording and analyzing the data by computers and the limits imposed by the existing knowledge. The appendix contains a rationale of those physiologic measures which have been employed by other investigations to study emotional reactions to stimuli of short duration.
Author (TAB)

N67-20517*# Colorado State Univ., Fort Collins. Coll. of Engineering.
COLLOID PARTICLE FORMATION FROM BIOLOGICAL WASTES
G. W. Tompkin, Jr. *In its* Advanced Elec. Propulsion Res. Jan. 1967 6 p refs (See N67-20509 10-28) CFSTI: HC $3.00/MF $0.65

The first results of investigation on the use of organic macromolecules in the colloid particle thrustor of an electric propulsion system are reported. The desired characteristics are delineated, and the factors favoring the use of the organic macromolecules are outlined. Particle production methods reviewed are: chemical rupture of peptide bonds in the polypeptide chain; rupture of the disulfide bonds between cystine residues in adjacent polypeptide chains; and the dissociation of the noncovalent bonds of the distinct chains of the hemoglobin molecule. N.E.N.

N67-20519# Naval Radiological Defense Lab., San Francisco, Calif.
DNA SYNTHESIS IN RELATION TO CELL DIVISION IN *TETRAHYMENA PYRIFORMIS*
I. L. Cameron (New York State Univ.) and D. Stuart Nachtwey 12 Oct. 1966 33 p refs Prepared jointly with New York State Univ.
(USNRDL-TR-1084; AD-642777) CFSTI: HC $3.00/MF $0.65

The effect of different nutritional conditions on the durations of the G1, S, G2 and D periods of exponentially replicating Tetrahymena pyriformis strain HSM was determined with autoradiographic techniques and observation of individual cells. The data indicate that, with decreased availability of nutrients, DNA synthesis is initiated proportionately later in the cell division cycle and that the proportion of the cell cycle spent in DNA synthesis increases. The effect of temperature on the relationship of the phases of the cell cycle was examined. Between 29 and 20C, the generation time and the time spent in the G2 period about double while the time spent in the S phase remains about the same. This phenomenon results in a reduction in the proportion of the generation time spent in the S phase and a compensatory increase in the G1 phase proportion. These results are discussed as they relate to nutritional factors involved in initiation and maintenance of DNA synthesis.
Author (TAB)

N67-20541# Naval Medical Research Inst., Bethesda, Md.
ALONE TOGETHER
W. W. Haythorn and I. Altman [1966] 17 p
(AD-641288) CFSTI: HC $3.00/MF $0.65

A study was made to determine what happens when pairs of men are locked together around the clock that would not happen if they were merely fellow workers or roommates who went their own ways at night. Eighteen pairs of men--young sailors in boot training--were selected to meet certain conditions of compatibility, in order to determine how much of the stress of isolation could be relieved by properly matching personalities. They were tested and rated in four personality dimensions: need for achievement; need for dominance; need for affiliation; need for dogmatism. They were then matched in such a way that in one-third of the pairs both men were high in each of these dimensions, in one-third both were low, and in the final third one was high and one low. The control group, composed of similar pairs, followed the same work schedule in identical, confined rooms, but were not confined around the clock. The study demonstrates clearly that the stresses of isolation are considerably affected by the relations between personality types. Good adjustment may decrease or modify stress in constructive ways; bad adjustment may increase, exaggerate, or complicate it, sometimes in destructive ways.
TAB

N67-20542# School of Aerospace Medicine, Brooks AFB, Tex.
A PRIMER OF VESTIBULAR FUNCTION, SPATIAL DISORIENTATION, AND MOTION SICKNESS
Kent K. Gillingham Jun. 1966 74 p refs *Its* Review 4-66
(AD-637943) CFSTI: HC $3.00/MF $0.65

CONTENTS: Review of Vestibular Function: Anatomy; Physiology; Review of Proprioceptive Function: Anatomy and physiology; Spatial Disorientation: Instrument flying; Formation flying; Causes of Spatial Disorientation; Statistics; Preventive measures; Motion Sickness: Importance; Etiology; Management. TAB

N67-20559# Honeywell, Inc., St. Paul, Minn. Research Dept.
INTRASPECIES BIOLOGICAL AND BEHAVIORAL VARIABILITY, 1 NOVEMBER 1965–31 OCTOBER 1966
S. P. Stackhouse and N. A. Sidley 31 Oct. 1966 149 p refs
(Contract AF 41(609)-2937)
(Rept.-12026-FR1; AD-642417) CFSTI: HC $3.00/MF $0.65

Experiments were conducted using men and Rhesus monkeys to examine the variability of responses within and between species as well as parameter variability in time. The monkeys were exposed to 400 Roentgens of ionizing radiation. Five classes of data were collected: behavioral, hematological, blood chemistry, electrophoretic, and electrophysiological. Several parameters were measured repeatedly within each data class. Data analyses showed that in general: (1) the between species variables correlate sufficiently to provide a basis for extrapolating monkey radiation effects data to humans; (2) these variables show no significant time trends; (3) some of the variables within each data class were significantly altered by radiation; (4) monkey pre- and post-radiation groups could be formed; and (5) predictors could be identified.
Author (TAB)

N67-20668# Naval Radiological Defense Lab., San Francisco, Calif.

EFFECTS OF CONTINUOUS LOW-LEVEL GAMMA IRRADIATION ON CIRCULATING AND PERITONEAL MONONUCLEAR LEUCOCYTES OF MICE

Lottie Kornfeld and Vivian Greenman 20 Oct. 1966 26 p refs
(USNRDL-TR-1985; AD-642788) CFSTI: HC$3.00/MF$0.65

LAF1 mice were exposed continuously to Co60 gamma radiations at a dose rate of 1.4 rads per hour. The number of lymphocytes in the circulating blood fell sharply during the first week of exposure (190 rads) and decreased thereafter at a very gradual but statistically significant rate for the duration of the experiment (15 weeks, 3450 rads). The disappearance of small lymphocytes (6 microns in diameter) from the peritoneal cavity was also more rapid during the first week of irradiation than during subsequent weeks. Medium peritoneal lymphocytes (8-10 microns in diameter) and peritoneal macrophages disappeared at constant rates over the entire observation period. After the first week of exposure, the disappearance rates of small and medium peritoneal lymphocytes were identical. This rate was greater than that for peritoneal macrophages and that for circulating lymphocytes. Based on the fraction of cells surviving any given exposure, the mononuclear leucocytes may be arranged in the following order of decreasing sensitivity to continuous low dose rate gamma irradiation: circulating lymphocytes, small peritoneal lymphocytes, medium peritoneal lymphocytes, peritoneal macrophages. This order is the same as that after acute exposure to X rays. Author (TAB)

N67-20670# Massachusetts Inst. of Tech., Cambridge.

DYNAMICS OF THE SACCADIC EYE-MOVEMENT MECHANISM. NEUROLOGICAL SERVOMECHANISMS. SECTION I:

Gerald Cook and Lawrence Stark 9 Nov. 1966 125 p refs
(Contract AF 49(638)-1313)
(DSR-75002; AFOSR-66-2640; AD-642126) CFSTI: HC $3.00/MF$0.65

Dynamics of saccadic eye-movement mechanism: An on-line computer was used to experimentally measure the dynamic performance of horizontal eye movement saccades. A mathematical model based upon physiological measurements in the literature was assembled for the plant--eyeball and eye muscles., and the controller signals-EMG. Simulation of the model with parameter adjustment led to reasonably close agreement between model and experimental overall behavior. It was found that actual movements require about three times as long for completion as would be necessary if the system operated with a minimum time policy. Neurological servomechanisms: The transfer function of the crayfish photoreceptor is examined, and successive refinements of technique and recording in three series of experiments are described. In the first series of experiments gross recordings were made of averaged frequency responses to sinusoidal inputs at several different frequencies. The instrumentation of the first experimental series was supplemented in the second and third series of experiments by a pulse height window which permitted only pulses from fibers responding to light intensity to be recorded. In addition, more experimental points were recorded than in the first series. Author (TAB)

N67-20625# Union Carbide Corp., Tonawanda, N. Y. Research Lab.

MOLECULAR INTERACTIONS OF WATER IN BIOLOGICAL SYSTEMS Final Report

G. F. Doebbler 1 Nov. 1966 32 p refs
(Contract AF 49(638)-1611)
(AFOSR-66-2762; AD-643438) CFSTI: HC$3.00/MF$0.65

The study is concerned with the molecular interactions of water in systems of biological interest as examined by techniques of thermal neutron inelastic scattering spectroscopy (NIS). Spectra were determined for water and solutions of the inert anesthetic gases, xenon, nitrous oxide and ethylene. Spectra were also determined for solutions of xenon at 1C and increased pressures and xenon hydrate (Xe 5.75 H2O) and compared with spectra for water, ice and other known hydrates. Differences were observed between the spectra of xenon hydrate and ice but NIS was relatively insensitive to long range crystallographic order differences in these extensively hydrogen bonded structures. Small changes in the NIS spectrum of water are induced by inert gases. With xenon these changes are enhanced at reduced temperature and increased pressure. Definitive interpretation of the spectral changes cannot be made since it appears that associated units in liquid water are highly variable with regard to size, structure or structural perfection and give rise to broad dispersions of lattice frequencies which obscure structural details. Author (TAB)

N67-20650# Aerospace Medical Div. Aerospace Medical Research Labs. (6570th), Wright-Patterson AFB, Ohio.

STANDARDIZATION OF SYMBOLS AND UNITS FOR ENVIRONMENTAL RESEARCH

W. C. Kaufman Aug. 1966 11 p refs
(AMRL-TR-66-115; AD-644684) CFSTI: HC$3.00/MF$0.65

A logical system of symbols to designate the widely accepted biological variables routinely measured in environmental research is described. Upper case letters are used for three major symbols of temperature, heat quantity, and rate of heat transfer. These are modified by upper case subscripts for physical variables and lower case subscripts for biological variables. Author (TAB)

N67-20654# School of Aerospace Medicine, Brooks AFB, Tex.

GEOGRAPHIC AND ASTRONOMIC DISTANCE RESPONSES BY RATED OFFICERS

Bernard I. Grosser Oct. 1966 8 p refs *Its* Aeromed. Rev. no. 5-66
(AD-644155) CFSTI: HC$3.00/MF$0.65

The data demonstrate that knowledge of distance around the earth, distance to the moon, and distance to the sun cannot be used as a test for organic brain damage in rated pilots and navigators. The diagnosis of organicity based on fund-of-information deficit is predicated on the principle that a given population normally has knowledge of the facts which are employed in the examination. The most nearly perfect answer was in response to the question of distance around the earth; however, the fact that more than 1 in 10 rated officers gave an incorrect response precludes the use of this question as a test for organic deficit. Author (TAB)

N67-20658# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

ELECTRON-MICROSCOPE INVESTIGATION OF BACTERIA AND PHAGES

A. P. Pekhov 13 Jun. 1966 302 p refs Transl. into ENGLISH of the book "Elektronnomikro-Skopicheskoye Issledovaniye Bakteriy i Fagov" Moscow, Gos. Izd. Med. Lit., 1962 224 p
(FTD-TT-65-1922; TT-67-60330; AD-644142) CFSTI: HC $3.00/MF$0.65

The monograph gives a practical course in electron microscopy and presents the modern achievements of the submicroscopic techniques of studying bacteria and phages. Methods of electron microscopic analysis of bacteria and phages, techniques of preparing ultrathin bacterial and phage sections, as well as data on the ultrastructure of bacteria and phages and on the development of phages within the bacteria, are presented in detail. TAB

N67-20695# Instituto de Neurologia, Montevideo (Uruguay).
EFFECTS OF PSYCHOPHARMACOLOGIC DRUGS UPON SENSORY INFLOW IN NORMAL SUBJECTS, IN PSYCHIATRIC PATIENTS AND IN ANIMALS Annual Report, Oct. 1, 1965–Sep. 30, 1966
Elio Garcia Austt Sep. 1966 12 p refs
(Grant DA-ARO-49-092-66-G100)
(Rept.-2; AD-643985) CFSTI: HC $3.00/MF $0.65

Averaged visual evoked potentials are being studied in man and animals by means of a computer of average transients (CAT). Modifications incorporated to this computer are described. Effects of psychotropic drugs upon the averaged visual evoked response (VER) in normal subjects are studied. LSD 25 determined multiplication of the waves. The response amplitude increased during continuous flicker stimulation instead of decreasing as observed in controls. Chlorpromazine reduced VER amplitude both in wakefulness and sleep. Stupour and coma VER was simple, lower amplitude than normals. Stuporous subjects important changes were observed generally in conjunction with modifications in background activity indicative of changes in the level of awareness. Effects of same drugs upon visual inflow along primary and secondary visual pathways were studied in cats. LSD 25 VER changed in pattern as well as in amplitude. An increase in latency of secondary waves was evident. Chlorpromazine provoked an increase of primary response with small doses. Larger doses tended to decrease it and to reach normal amplitude. Author (TAB)

N67-20744*# Sandia Corp., Albuquerque, N. Mex.
MICROBIOLOGICAL STUDIES RELATING TO CLEAN ENVIRONMENTS. PART II: DEPOSITION OF NUTRIENTS TO SURFACES BY RODAC PLATES
John William Beakley, W. J. Whitfield, and J. C. Mashburn Sep. 1966 8 p refs
(NASA Order R-09-019-040; Contract AT(29-1)-789)
(NASA-CR-83053; SC-RR-66-386) CFSTI: HC $3.00/MF $0.65
CSCL 06M

The deposition of nutrient residues onto surfaces following impressions made with Rodac plates was observed, photographed, and quantitated. In the experiments performed, a medium residue between 20 and 50 micrograms in weight was deposited from Rodac plates onto stainless steel surfaces. Such residues were shown to be adequate to support microbial growth when such surfaces were contaminated and incubated under ideal conditions of humidity and temperature. Author (NSA)

N67-20747# Staatliche Zentrale fuer Strahlenschutz, Berlin (East Germany).
MODERN METHODS OF PERSONNEL DOSIMETRY [MODERNE METHODEN DER PERSONENDOSIMETRIE]
W. Kraus, D. Herrmann, and W. Kiesewetter Jul. 1966 48 p refs In GERMAN; ENGLISH summary
(SZS-6(1966))

Physical properties of radiation detectors used in personnel dosimetry are considered. The applicability of the various dosimeters is discussed for the purposes of personnel monitoring in single institutes and in control centers, for accidential and other high level dosimetry, and for the dosimetry in natural radiation fields and in space. Difficulties in the interpretation of dosimeter responses with regard to the organ dose are briefly reviewed. Author (NSA)

N67-20779# Colorado Univ., Boulder.
RADIATION EFFECTS IN BIOCHEMISTRY AND ORGANIC CHEMISTRY Technical Progress Report, 15 Oct. 1965–14 Oct. 1966
Bert M. Tolbert et al 14 Oct. 1966 133 p refs
(Contract AT(11-1)-690)
(TID-23265) CFSTI: HC $3.00/MF $0.65

Results are presented from studies on the effects of ionizing radiation in purified compounds found in biological systems, with emphasis on solid amino acids, peptides, and proteins. Data are included on the effects of ^{137}Cs γ radiation on the denaturation of α-chymotrypsin; mechanisms of radioinduced denaturation of enzymes; the relationship of stable free radicals to radiation damage in lysozyme; hydrogen exchange in lysozyme; γ radiation effects on reversible configurational damage in lysozyme determined by tritium exchange methods; energy transfer during γ inactivation of the allosteric, oligomeric enzyme aspartate transcarbamylase (ATCase); the effects of γ radiation on the allosteric properties of hemoglobin; the effects of γ radiation on the activity of dehydrogenase enzymes and radiation energy transfer in several dehydrogenase enzymes; and the γ induced decarboxylation of DL-phenylalanine at low energy inputs. A list is included of 28 publications since 1964. NSA

N67-20960# Massachusetts Univ., Amherst.
INHIBITION OF THE SYNTHESIS OF MACROMOLECULES BY ULTRAVIOLET RADIATIONS Final Report, 1 Feb. 1965–31 Jul. 1966
Paul A. Swenson 15 Sep. 1966 9 p refs
(Contract AT(30-1)-3511)
(NYO-3511-2) CFSTI: HC $3.00/MF $0.65

Progress is reported on studies on the effects of uv radiation on the synthesis of macromolecules by radiosensitive and radioresistant strains of *Escherichia coli*. Data are included from studies on the effects of uv radiation on the β-galactosidase-forming ability of the bacteria at various temperatures from 5 to 37°C. The radiosensitivity of tryptophanase and d-serine deaminase systems in the two strains was also studied. Strain differences in enzyme-forming ability, dark repair, response to photoactivating light, respiration, and RNA and protein synthesis were found in the uv-irradiated bacteria. NSA

N67-20976# Commissariat a l'Energie Atomique, Grenoble (France). Centre d'Etudes Nucleaires.
RADIOSENSITIVITY OF CHLORELLA AFTER MEDIUM ENERGY ACCELERATED ELECTRON IRRADIATION [RADIOSENSIBILITE DES CHLORELLES AUX ELECTRONS ACCELERES DE MOYENNE ENERGIE]
Jean-Claude Roux Jun. 1966 72 p refs In FRENCH
(CEA-R-2984)

Survival curves were constructed for *Chlorella pyrenoidosa* exposed to 0.65 and 1 Mev electron beams. Multiplication capacity was determined for cells on porous membranes, and dose was calculated by Fricke dosimetry. Anoxia was shown to be more effective in survival than dose fractionation. RBE of 0.65 and 1 Mev electrons was less than that of 180 kev X-rays. NSA

N67-21030# Institute For Defense Analyses, Arlington, Va.
ON THE THEORY OF COILING AND UNCOILING OF DNA MOLECULES
Elliott W. Montroll *In* Brookhaven Natl. Lab. Inelastic Scattering of Neutrons by Condensed Systems Mar. 1966 p 57–68 refs (See N67-21022 10-24)) CFSTI: HC $3.00/MF $0.65

The structure of the DNA molecule is considered, and various models for the thermal splitting and uncoiling of this molecule are discussed. These include the random model, the model with nearest-neighbor correlations, the first form of the partition function for a mixed system, and regularly spaced type 2 bonds. NSA

N67-21142# Kernforschungsanlage, Juelich (West Germany). Zentralabteilung Strahlenschutz.
ON THE EFFECTS OF INCORPORATED PLUTONIUM [UEBER DEN NACHWEIS VON INKORPORIERTEM PLUTONIUM]
H. Jacobs Oct. 1965 31 p refs In GERMAN
(JUL-312-ST) CFSTI: HC $3.00/MF $0.65

The present stand of plutonium determination in the human body is reviewed. Pertinent works are presented in a bibliography covering the past 10 years. General characteristics of plutonium and its metabolism in the human body are briefly discussed in order to clarify methods and to assist in the evaluation of the results. Transl. by K.W.

N67-21143 Argentina. Comision Nacional de Energie Atomica, Buenos Aires.

TISSUE FILTERING OF I^{131} AND PERIPHERAL CIRCULATION [DEPURACION TISULAR DE I^{131} Y CIRCULACION PERIFERICA]

H. Garcia del Rio, V. Pecorini, and O. Degrossi 1966 12 p refs In SPANISH
(CNEA-174) CFSTI: $3.00

In order to determine the time lapse for tissue depuration, radiation counters were used to detect iodine 131 isotopes injected intravenously into human subjects. It was found that there was no difference in depuration time observed for I^{131} or Na^{24} isotopes in normal subjects or patients suffereing from arteriopathy. In areas where sodium 24 is impossible to obtain or uneconomical to use, the most appropriate clinical method recommended for the study of peripheral arteriopathy is iodine 131 tissue depuration. Transl. by R.Ll.

N67-21152# Argentina. Comision Nacional de Energie Atomica, Buenos Aires.

ON THE SYNTHESIS OF INDIGOTIN FROM N-(CARBOXYMETHYL)-ANTHRANILIC ACID [SOBRE LA SINTESIS DE LA INDIGOTINA A PARTIR DE ACIDO N-(CARBOXIMETIL)-ANTRANILICO]

Mauricio F. Buehler, Aldo E. A. Mitta, and Rodolfo Lopez 1966 8 p refs In SPANISH Presented at the 11th Session of the Argentine Chem. Assoc., Bahia Blanca, Argentina, 1964 Submitted for publication
(CNEA-178) CFSTI: HC$3.00/MF$0.65

Using ^{14}C as a tracer, an experiment was performed to show which of carboxyls of n-(carboxymethyl)-anthranilic acid participates in the formation of the heterocycle of indoxyl and which is elminated during the reaction. Experimental results outlined confirm the mechanism previously agreed upon for the reaction, which is the intermediate formation of indoxylic acid although the small activity of the indigotin obtained leads to the assumption that although in a small proportion (0.6%), the extranuclear carboxyl participates in the formation of the heterocycle. Transl. by R.Ll.

N67-21177*# Army Biological Labs., Fort Detrick, Md.

QUANTITATIVE SPORE RECOVERIES FROM DIATOMACEOUS EARTH PELLETS USED AS PROTECTIVE MATERIAL IN DRY HEAT STERILIZATION STUDIES

Dorothy M. Portner 23 Feb. 1967 6 p refs *Its* Rept.-13-67
(NASA Order R-35)
(NASA-CR-83122) CFSTI: HC$3.00/MF$0.65 CSCL 06M

The selection of materials to simulate electronic components to determine their ability to withstand sterilization procedures is discussed. Diatomaceous earth was investigated by comparing the bacterial recoveries from diatomaceous earth pellets and from glass surfaces after exposure to dry heat at 105° or 125°C. After the heat treatment, samples were shaken and assayed by the pour plate method using trypticase soy agar as the culture medium. The results of the study indicated that death rate for *B. subtilis* var *niger* spores exposed to dry heat is considerably slower when the spores are in diatomaceous earth than when they are on the exterior glass surface. The D values calculated from the results were 240 and 400 min for spores on glass and diatomaceous earth respectively at 105°C, and 17 and 28 min at 125°C. Tabulated data show that comparable recoveries can be obtained with diatomaceous earth pellets. L.E.W.

N67-21340# Hiroshima Univ. (Japan). Dept. of Physiology.

MECHANISMS OF SMOOTH MUSCLE RELAXATION THROUGH THE ANODAL CURRENT STIMULATION Final Report, Oct. 1965–Oct. 1966

Hiroshi Irisawa Nov. 1966 43 p refs
(Contract DA-92-557-FEC-38715)
(J-220-10; FR-10; AD-644249) CFSTI: HC$3.00/MF$0.65

The comparative physiological method was combined with the electrophysiological method in an attempt to resolve the problems related to the mechanisms of relaxation of the involuntary muscle system. The effect of sodium ion on the mammalian smooth muscles, vertebrate myocardium, and invertebrate myocardium has been compared since 1962. Effect of higher sodium concentration on the myocardium was obtained by using the skate myocardium without changing the osmotic pressure of the bath. The results of this study will be published in the Journal General Physiology. A continuation of this research is in progress by studying the effect of Ca(++) on the myocardium. In the skate myocardium, the elevation in action potential by increasing Ca(++) was found to be caused by the increased availability of Na carrier and probably not by the direct inflow of Ca(++) into the cell. On the other hand, in the invertebrate myocardium such as molluscus, Ca(++) appears to play a very important role for the initiation of action potential. The heart muscle of the oyster can continue to contract spontaneously in Na free solution. Amplitude of action potential of the oyster myocardium increased 29 mV by a 10 fold increase in extracellular Ca concentration. Spontaneous activity was not diminished in a relatively high concentration of puffertoxine but was inhibited by the administration of manganese ion. All these facts indicate that the inward current may be carried by Ca(++) ion in the extreme condition in this heart muscle. In connection with this study, the ionic concentrations of intracellular Na and K were studied in the skate myocardium and similar measurements are being made on other muscles. Author (TAB)

N67-21424*# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.

EFFECT OF CHRONIC RESTRAINT GASTROINTESTINAL FUNCTION

Maurice Sullivan Mar. 1967 26 p refs
(NASA Order A-73704)
(NASA-CR-73071) CFSTI: HC$3.00/MF$0.65 CSCL 06P

Purpose of the study was to determine if the prolonged restraint of laboratory animals (the rat) adversely affects absorption of fluid and electrolytes. Experiments were performed to determine: (1) the influence of chronic restraint on the transport properties of the rat small intestine for electrolyte and fluid, both *in vitro* *in vivo*; (2) if chronic restraint causes latent effects that are manifested by more severe acute restraint; and (3) if the effects of chronic restraint and the known changes in function that occur after exposure to ionizing radiation are additive. Data were also obtained of the the effect on calcium absorption and retention, body, kidney, femur and femur ash weight, and the histopathology of the rat small intestine. The results do not indicate a deleterious effect either on intestinal function or on the susceptibility of the small intestine to more severe stress. Growth depression due to chronic restraint was noted, and it was found that weights of body, femur, and kidney were depressed in the same proportion. Bone mineralization is thought to be transiently affected. K.W.

N67-21435# Illinois Univ., Urbana. Dept. of Psychology.

SPECULATION ON THE STRUCTURE OF INTERPERSONAL INTENTIONS

Charles E. Osgood Sep. 1966 54 p
(Contract Nonr-1834(36); ARPA Order 454)
(TR-39; AD-643277) CFSTI: HC$3.00/MF$0.65

A model is presented in which dimensions are hypothesized to operate as a simultaneous bundle of distinctive features which mediate the meaning of behavioral events, either perceived or

intended. It is suggested that, if the dimensional structure of interpersonal intentions is culturally invariant, manifest differences in behavioral prescription and expression can be economically compared. Assuming the dimensions themselves are culturally common, cultural differences reside in (1) the allocation of interpersonal intentions within the dimensional system, (2) the appropriateness or frequency with which intentions are said to characterize different role-pairs, and (3) the translation of intention into overt behavior or, conversely, the inference of intention from perceived behavior. Here, the concern was to develop a set of a priori features through a rational analysis of the language of interpersonal behavior and to show that a relatively small set of distinctive features can discriminate among a large number of interpersonal verbs. Six features were initially proposed. Index categories of Rogets Thesaurus were then sampled for representative, interpersonal verbs. Two hundred and ten verbs obtained in this manner were judged and coded on each of the six features. Face validity of the features was presented in terms of the resulting word clusters formed and differentiated on the basis of the feature scoring. Characteristics of the six features, their coding distribution and intercorrelation with other features was also provided.
Author (TAB)

N67-21452*# National Aeronautics and Space Administration, Washington, D. C.
VARIATIONS IN RESPIRATION PROCESS DURING GAMMA RADIATION OF PLANT TISSUE [IZMENENIYA V PROTSESSE DYKHANIYA PRI GAMMA-OBLUCHENII RASTITEL'NOY TKANI]
I. P. Petrash and L. V. Metlitskiy Mar. 1967 9 p refs Transl. into ENGLISH from Dokl. Akad. Nauk SSSR (Moscow), v. 170, no. 3, 1966 p 711–713
(NASA-TT-F-462) CFSTI: HC $3.00/MF $0.65 CSCL 06R

Changes in the activity of tomato oxidizing enzymes under the influence of gamma irradiation established a drop in oxygen absorption ability from 80% for normal fruit to 0–10% in irradiated fruit. Ionizing oxidation disrupted the normal pattern of respiratory enzyme actions most pronounced in less ripe tomatoes. G.G.

N67-21478# Norsk Radiumhospital, Oslo.
INDUCED RADIOACTIVITY IN THE COLLIMATOR SYSTEM OF A 31 MeV BROWN BOVERI BETATRON
Aksel Stroemme [1959] 8 p refs
(Contract AT(30-1)-3364)
(NYO-3364-21) CFSTI: HC $3.00/MF $0.65

It is found that during use some radioactivity is induced in the collimator system of the BBC 31-MeV betatron. Direct handling of the equalizer system is to be avoided because otherwise the doses to the hands can exceed 150–200 mR a day. But if the hands are placed not closer than about 15 cm from the equalizer system, the dose to the hands will not exceed 3–4 mR even on a busy day. If care is taken the radiation hazards due to induced radio activity after collimator irradiation are of no practical importance. In modern betatrons the collimator system with the field equalizer is safely mounted inside the apparatus and remotely controlled, and there is thus no radiation hazard from the collimator system.
Author (NSA)

N67-21623# European Atomic Energy Community, Ispra (Italy). Joint Nuclear Research Center.
VALUE OF GAMMA SPECTROSCOPY APPLIED TO BIOLOGICAL SAMPLES [VALEUR DE LA SPECTROMETRIE GAMMA APPLIQUEE AUX ECHANTILLONS BIOLOGIQUES]
H. Tanguy and V. Camera Jul. 1966 20 p refs In ITALIAN
(EUR-2998.f)

The analysis of biological samples has fewer applications than whole-body counting, nevertheless it has value when applied to biological specimens such as urine and feces. The authors establish the normal spectra for urine and feces and find a net increase in ^{137}Cs in urine after the middle of 1963. Body burdens calculated from the concentrations in the urine were higher than in other places where the same measurements were done. The authors report results on spectra of some cases of slight contamination that were found at Ispra. Contamination was due to ^{203}Hg, ^{134}Cs, $^{152,154}Eu$ and other uranium fission products.
Author (NSA)

N67-21676*# Sandia Corp., Albuquerque, N. Mex.
MICROBIOLOGICAL STUDIES RELATING TO CLEAN ENVIRONMENTS. PART I: EVALUATION OF THE EFFICIENCY OF A CLASS 100 LAMINAR-FLOW CLEAN ROOM FOR VIABLE CONTAMINATION CLEANUP
John William Beakley, W. J. Whitfield, and J. C. Mashburn Sep. 1966 8 p refs
(NASA Order R-09-019-040; Contract AT(29-1)-789)
(NASA-CR-83246; SC-RR-66-385) CFSTI: HC $3.00/MF $0.65 CSCL 06T

A laminar-flow wall-to-floor clean room was challenged with *Bacillus subtilis* spores and then tested for efficiency of cleanup using both electronic and viable particle detection systems. The results confirmed the extreme efficiency of laminar-flow systems in reducing airborne viable particles to an absolute minimum.
Author (NSA)

N67-21698# School of Aerospace Medicine, Brooks AFB, Tex.
INSTRUMENTED IDENTIFICATION FOR BACTERIAL DIFFERENTIATION. A. THE BAIT AND TAMIS CONCEPT. B. IMMUNOELECTRONIC PRINCIPLES AND INSTRUMENTATION
Irving Davis, William G. Glenn, Warren J. Russell, Wesley E. Prather, and Heinz A. Jaeger Nov. 1966 18 p refs
(SAM-TR-66-61; AD-643948) CFSTI: HC $3.00/MF $0.65

The BAIT (Bacterial Automated Identification Technic) concept for identification of bacteria, appropriate for small area-point source coverage, is outlined. Coupling of the BAIT instrument with other medical defense requirements is described. Finally, a concept for large area coverage for biologic agent identification is presented. This is the TAMIS (Telemetric Automated Microbial Identification System) concept. The differentiation of bacterial extracts by precipitin analyses has been well established by the researches of numerous investigators. Advances in instrumentation have made the quantitation of this type of antigen-antibody reaction both exacting and efficient. This report emphasizes principles of quantitation, methods, and instruments currently in use for electronic data reduction and evaluation of the comparability of precipitin reactions.
Author (TAB)

N67-21708*# Massachusetts Inst. of Tech., Cambridge. Research Lab. of Electronics.
ACOUSTICALLY EVOKED POTENTIALS IN THE RAT DURING CONDITIONING
Robert D. Hall and Roger Greenwood Mark 30 Nov. 1966 89 p refs
(Grants NsG-496; NSF GK-835; NIH G-MH-04737-06; Contract DA-36-039-AMC-03200(E))
(NASA-CR-83248; TR-455; AD-644853) CFSTI: HC $3.00/MF $0.65 CSCL 06B

Acoustically evoked potentials were recorded from unanesthetized rats in a series of experiments designed to study changes in evoked potentials during conditioning. It is shown that when clicks are established as conditional stimuli (CS) in conditioned emotional response (CER) situations, click-evoked potentials recorded from central auditory structures and from mesencephalic reticular formation exhibit amplitude increases. Similar increases were found with Sidman avoidance conditioning. These changes during aversive conditioning were not related to acquired discriminative

properties of the acoustic stimulus, since similar changes in click-evoked potentials were found when a CER was elicited by a photic CS. The changes were shown to be independent of movement-related variables. Potentials evoked in central auditory structures by electrical stimulation of the cochlear nucleus or cochlea increased in amplitude during acquisition of a CER. In one CER situation nearly all movement was eliminated through methods of behavioral control, and data-sampling techniques provided a control for residual differences in amount of movement during CS and control periods. These procedures did not eliminate increases in click-evoked potentials during conditioning. In general, whenever behavioral measures indicated that rats were frightened, acoustically evoked potentials exhibited increased amplitudes, whether or not a CS was present, but only changes in late components of click-evoked potentials were consistently related to observed behavioral changes. Author (TAB)

N67-21715# Illinois Univ., Urbana. Group Effectiveness Research Lab.

A METHODOLOGICAL STUDY OF BEHAVIORAL AND SEMANTIC DIFFERENTIAL SCALES RELEVANT TO INTERCULTURAL NEGOTIATIONS

Earl E. Davis Jun. 1966 74 p refs

(Contract Nonr-1834(36); ARPA Order 454)

(TR-32; AD-643274) CFSTI: HC$3.00/MF$0.65

One hundred and fifty students, including 84 white male and 66 negro male Ss, rated 32 complex person stimuli on 18 behavioral differential (BD) and 19 semantic differential (SD) scales, as well as 24 socio-political issues on a set of 10 SD scales. The BD scales were selected for their relevance to intercultural negotiations between the two subject groups; the SD scales were selected for their appropriateness in rating person stimuli and issues, as opposed to more general SD scales. The scales, stimuli and subjects generated a cube of data such that variation in any of the three faces of the cube could be a source of variation in factor structure. The techniques for dealing with this three-way correlational and factorial problem were described. Factor analyses of scales were performed; analyses of variance of the factorial design of the stimuli were performed for each scale factor, and comparisons were made between the two subject populations. Factor analysis of the BD scales yielded, among others, a cooperation factor which, it was felt, might be particularly important predictor variable in intercultural negotiations. Factor analysis of the SD scales used to judge person stimuli yielded five interpretable factors closely paralleling those found by Osgood and Ware in their work with the personality differential. Factor analysis of the scales used to judge issues yielded three factors specific to this domain of stimuli. A comparison of the results obtained from the white and negro subjects was made, and the factorial similarity of the scale factors for the two S types was measured. TAB

N67-21736# Naval Radiological Defense Lab., San Francisco, Calif.

THE RADIATION RESISTANCE OF LONG-LIVED LYMPHOCYTES AND PLASMA CELLS IN MOUSE AND RAT LYMPH NODES

John J. Miller, III and Leonard J. Cole 23 Sep. 1966 28 p refs

(USNRDL-TR-1074; AD-644116) CFSTI: HC$3.00/MF$0.65

Rats and mice were given a secondary immunological stimulus with TAB vaccine and then were given twice daily injections of tritiated thymidine for 4 days into the hind foot pad. Thirty days later the mice were exposed to 850 rad, 500 rad, or were left nonirradiated and the rats were exposed to 850 rad or left nonirradiated. Despite a marked, generalized destruction of lymphocytes, the aortic nodes of the mice and the popliteal nodes of the rats had larger values for percent of small lymphocytes labeled in the period immediately following irradiation than did the nodes from the nonirradiated control animals. The mean grain counts of the labeled small lymphocytes from irradiated animals were equal to or larger than those from nonirradiated animals. These results are interpreted as demonstrating a relative radio-resistance of long-lived, lymph node lymphocytes. Large numbers of persistently labeled plasma cells were also found in lymph nodes after irradiation. No difference could be found in the numbers or distribution of labeled plasma cells in lymph nodes from irradiated mice compared to lymph nodes from nonirradiated mice. There may have been a loss of a small proportion of the long-lived plasma cells present in the rat lymph nodes. It is believed that the ability of plasma cells to survive irradiation explains the radio-resistance of established antibody production. Author (TAB)

N67-21753 Rome Univ. (Italy).

STUDY OF THE ACTION MECHANISM OF IONIZING AND ULTRAVIOLET RADIATIONS *IN VITRO* CULTURES OF MAMMALIAN CELLS [STUDIO DEL MECCANISMO D'AZIONE DELLE RADIAZIONI IONIZZANTI ED ULTRAVIOLETTE NELLE CELLULE DI MAMMIFERO IN COLTURE IN VITRO] Annual Report, 1 Nov. 1964–31 Oct. 1965

Brussels, EURATOM, 1967 21 p In ITALIAN; ENGLISH summary

(Contract EUARTOM-036-64-6 BIOI)

(EUR-3266.i) CFSTI: $3.00

The main work was devoted to the solution of the following problems: (1) preparation of the apparatus for uv irradiation of cells and relative dosimetry; (2) determination of the chromosome and growth characteristics (relative length of the various phases of the cellular cycle) of the strains to be used in the experiments; (3) analysis of the survival of cells irradiated with various doses and various wavelengths of uv light; and (4) frequency and type of chromosome aberrations induced in cells irradiated with various doses and various wavelengths of uv light. In addition, certain experiments have been undertaken to determine the possibility of inducing chromosome ruptures in cells pretreated with a furocoumarin (8-methoxypsoralen) and subsequently irradiated with uv of 3650 Å. Author

N67-21815# Florida Univ., Gainesville. Dept. of Pathology

BIBLIOGRAPHY OF THE TOXICOLOGY OF NICKEL CARBONYL

F. William Sunderman, Jr. 1 Jul. 1966 6 p refs

(Contract AT(40-1)-3461)

(ORO-3461-8a) CFSTI: HC$3.00/MF$0.65

A list of 46 references to information on the toxicology of nickel carbonyl is given. NSA

N67-21817# Florida Univ., Gainesville. Dept. of Pathology.

BIBLIOGRAPHY OF NICKEL CARCINOGENESIS

F. William Sunderman, Jr. 1 Jul. 1966 7 p refs

(Contract AT(40-1)-3461)

(ORO-3461-8b) CFSTI: HC$3.00/MF$0.65

Sixty-three references pertaining to the carcinogenic effects of nickel are presented. Papers on clinical and experimental studies are included, as well as those treating occupational parameters of respiratory tract carcinogenesis. NSA

N67-21853# Naval Ordnance Test Station, China Lake, Calif.

THE TRANSMISSION OF ARBITRARY ENVIRONMENTAL INFORMATION BETWEEN BOTTLE-NOSE DOLPHINS

Jarvis Bastian (Calif. Univ., Davis) Jan. 1967 53 p refs

(NOTS-TP-4117; AD-646241) CFSTI: HC$3.00/MF$0.65

An investigation was made of the capacity of a pair of bottle-nose dolphins to perform a cooperative task which required the acoustical transmission of information about an arbitrary visual

event in the environment of one of the animals. Each animal was first trained to press one of two paddles, depending upon the state of a light signal. Next, while housed in adjacent enclosures, they were required to coordinate their actions in a fixed sequence and within fixed time limits. Then the light signal to the animal required to respond first was removed, and visual contact with the other animal and its light was eliminated. The pair continued to perform successfully as long as they were in acoustical contact and the light signal to the one animal was provided. Their performance success was found to depend directly upon the emission of pulse trains by the animal receiving the light signal, although it was also found to be indirectly connected with that animals emission of whistle signals. The specific nature of this dependency could not be determined. Author (TAB)

N67-21856# Army Medical Research Lab., Fort Knox, Ky. Experimental Psychology Div.
VISUAL-AROUSAL INTERACTION AND SPECIFICITY OF NYSTAGMIC HABITUATION
John E. Marshall and James H. Brown 9 Dec. 1966 13 p refs (AMRL-688; AD-645926) CFSTI: HC $3.00/MF $0.65

Forty male Ss with no previous exposure to precise constant angular acceleration received 13 positive accelerations of 24 degrees/sq. sec. Vision was permitted for all Se on pre- and post-test criterion trials. Twenty Ss received concomitant visual stimulation with an illuminated visual field during 10 habituating trials. The remainder were habituated in complete darkness. Habituation acquired in darkness did not transfer to criterion trials with vision. Darkness habituated Ss showed a significant slow-phase increment when tested with vision following task-controlled arousal level increase. Ss habituated with vision showed a continued output decline when tested under similar conditions. Author (TAB)

N67-21879# Army Medical Research Lab., Fort Knox, Ky.
ABERRANT CORNEAL EPITHELIAL CELLS PRODUCED BY RUBY LASER IRRADIATION
W. H. Parr and Robert S. Fisher 31 Oct. 1966 31 p refs (AMRL-698; AD-645452) CFSTI: HC $3.00/MF $0.65

Rat corneas were exposed to either 4 joules per sq cm or 8 joules per sq cm and were harvested at varying times following laser exposure. Corneal whole mounts were evaluated for changes in either the differential mitotic cell count or the mitotic index. Ruby laser radiation (6,943 A) produces aberrations in the corneal epithelium of the rat. At 8 joules per sq cm both interphase cells and cells in active mitosis were obviously altered. At 4 joules per sq cm aberrant corneal epithelial cells became apparent immediately after laser irradiation, and some were still present 30 days later. The mechanism by which laser radiation alters the cornea remains obscure. Author (TAB)

05 BIOTECHNOLOGY

Includes life support systems, human engineering; protective clothing and equipment; crew training and evaluation, and piloting. For related information see also: 04 Biosciences.

N67-20396 Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
CERTAIN DYNAMIC CHARACTERISTICS OF THE OPERATOR IN TRACKING UNDER THE CONDITIONS OF SPACEFLIGHT ON THE VOSKHOD 2 CRAFT
P. I. Belyayev, A. A. Leonov, V. A. Popov, L. S. Khachatur'yan, and V. K. Filosofov *In its* Cosmic Res. 23 Jun. 1966 p 220–231 refs (See N67-20381 10-30) CFSTI: $3.00

The influence of various factors, including spaceflight, on certain dynamic characteristics of an operator forming part of a control system is considered, regarding the pilot as a dynamic element as he performs tracking problems. It is found that the quality of the operator's tracking in flight is lower than that observed on the ground. On the whole, however, the operator's tracking performance did not suffer serious changes under the conditions of the real day-long spaceflight including A.A. Leonov's emergence into open cosmic space. Author

N67-20398 Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ENDOGENIC FORMATION OF CARBON MONOXIDE AND ITS IMPORTANCE IN A CLOSED ECOLOGICAL SYSTEM
L. A. Tiunov and V. V. Kustov *In its* Cosmic Res. 23 Jun. 1966 p 232–244 refs (See N67-20381 10-30) CFSTI: $3.00

Presented is a literature survey on the endogenic formation, oxidation, and function of carbon monoxide in animal and plant tissues. Focused on is the importance of these processes in ecological cycles, and their importance to the design of spacecraft life support systems. Author

N67-20480# Federal Aviation Agency, Oklahoma City, Okla. Office of Aviation Medicine.
PROBLEMS IN DEPTH PERCEPTION: PERCEIVED SIZE AND DISTANCE OF FAMILIAR OBJECTS
Walter C. Gogel and Henry W. Mertens Jun. 1966 23 p refs (AM-66-22; AD-641477) CFSTI: HC $3.00/MF $0.65

Judgments of the distance of familiar objects, especially other aircraft, are critical aspects of flight safety. In this study, the perception of distance as a function of the retinal size of a familiar object was investigated by simulating a stationary or a radially moving playing card in an otherwise dark visual field. When different observers were first presented with the different sizes of the stationary object, a relation between retinal size and perceived distance occurred only if perceived size was taken into consideration and only for the largest two of the three retinal sizes used. It seems that familiar size was a cue to perceived absolute distance when the simulated distances were approximately 3 feet or less, but not approximately 6 feet from the observer. Judgments of the distance of subsequent static presentations of cards, while usually more veridical than first presentations, were found to be dependent upon distance judgments made in the prior presentations. The importance of interactions between presentations or within changing presentations was reflected in the modifications of the dynamic adjustments that resulted from using different starting sizes. The results from this experiment support the view that relational distance cues occurring between successive or sequential presentations are dominant over absolute distance cues occurring with respect to a single object. Author (TAB)

N67-20674# City Coll. of the City of New York. Hunter Coll.
MODES OF RESOLUTION, CONCEPT FORMATION, AND RESEARCH STRATEGY
Walter Weiss Nov. 1966 15 p refs (Contract Nonr-4309(00)) (RR-9; TR-9; AD-643168) CFSTI: HC $3.00/MF $0.65

Some characteristics and problems of a conceptual orientation, using the concepts of cognitive consistency-inconsistency and modes of resolution, are discussed. Contrasted is a more empirical approach which is open to a wide diversity of responses to stimulus situations. Some research is used to illustrate the heuristic value of the latter perspective in respect to communication effects. Author (TAB)

N67-20726# Bunker-Ramo Corp., Canoga Park, Calif.
HUMAN ENGINEERING SUPPORT TO AIR FORCE FLIGHT CONTROL AND FLIGHT DISPLAY INTEGRATION PROGRAM Final Report, 14 Mar.–24 Jun. 1966
Gerald F. Rabideau and Clarence A. Semple, Jr. Wright-Patterson AFB, Ohio, AF Flight Dyn. Lab., Oct. 1966 50 p refs
(Contract AF 33(615)-3757)
(AFFDL-TR-66-157; AD-644636) CFSTI: HC $3.00/MF $0.65

Among the research outputs were (1) a head-up display literature search and analysis, and (2) experimental design for dynamic (open-loop) study of moving tape scale variables. Among the continuing research tasks were: (1) visual requirements in cockpit displays under low ambient illumination, (2) switch type and location evaluation for control yoke, (3) V/STOL landing display literature search, and (4) Control-Display Information Center subjective index development. Additionally, the more extensive consulting tasks included: (1) V/STOL program development, (2) advanced multipurpose spacecraft display study, (3) V/STOL panel and cockpit mockup support, and (4) electroluminescent altimeter design concept evaluation. Author (TAB)

N67-21168* Arinc Research Corp., Annapolis, Md. Science Center.
HUMAN RELIABILITY PROGRAM FOR THE SATURN V LAUNCH VEHICLE GROUND SUPPORT EQUIPMENT
Harald R. Leuba Oct. 1965 33 p refs *Its* Publ.-294-25-34-539
(Contract NAS8-11087)
(NASA-CR-83119) CFSTI: HC $3.00 CSCL 05H

The prediction and evaluation of human reliability for the Saturn V launch vehicle ground support equipment are discussed. The investigation is divided into five major sections: (1) the purpose of the human reliability program, (2) a system description, (3) possible techniques for prediction and evaluation, (4) limitations of the study, and (5) recommended actions. The material presented does not solve human reliability prediction and evaluation problems, but it does describe those problems and provide quantitative recommendations on how they could be solved. Information requirements and alternative analytic procedures are listed. Author

N67-21171 Joint Publications Research Service, Washington, D. C.
ANALYSIS OF INTONATIONAL CHARACTERISTICS OF SPEECH AS A CRITERION OF THE EMOTIONAL STATE OF MAN UNDER CONDITIONS OF SPACE FLIGHT
V. A. Popov, P. V. Simonov, A. G. Tishchenko, M. V. Frolov, and L. S. Khachatur'yants 15 Feb. 1967 15 p refs Transl. into ENGLISH from Zh. Vysshei Nervnoi Deyatel'nosti (Moscow), v. 16, no. 6, 1966 p 974–983
(JPRS-39906; TT-67-30554) CFSTI: HC $3.00

The possibility of using speech color for determining the degree of emotional stress of cosmonauts was investigated. Tapes of actual conversations with cosmonauts, and also actor-imitated conversations were analyzed with the formant frequency method. The situations were associated either with progress in assignment completion (positive emotion), or with complications related to increasing danger (negative emotion). The voice frequencies were correlated with electrocardiograms and respiratory data. Among the conclusions are: (1) The spectrum characteristics of speech may be used for emotional stress evaluation. (2) An increase in stress can be coordinated with a rise in formant frequency and intensity. (3) Concurrent use of physiological data improves accuracy in determining operator's condition and also aids in differentiating between physical and emotional stress. N.E.N.

N67-21348# Lockheed Missiles and Space Co., Sunnyvale, Calif.
DEVELOPMENT OF AN INTEGRATED ERGOMETER/LOWER BODY NEGATIVE PRESSURE SYSTEM Final Report, Aug. 1965–Jun. 1966
F. E. Riley, C. C. Cain, and A. L. Weitzmann Brooks AFB, Tex., Aerospace Med. Div., 9 Dec. 1966 41 p refs
(Contract AF 41(609)-2800)
(LMSC-4-06-66-8; AMD-TR-66-4; AD-644224) CFSTI: HC $3.00/MF $0.65

The object of the program was to provide prototype equipment for use by the USAF in laborary studies of physiological deconditioning similar to that which results from space flight. Three successive versions of an integrated Ergometer/Lower Body Negative Pressure (LBNP) System were delivered to AMD. The ergometer consists of a self-powered bicycle type unit with a solid-state electronic control system to maintain constant generator output regardless of pedal rotation speed. Recording capabilities are provided for a tachometer, and a wattmeter. Provisions are made to attach power consuming or power storage devices to the ergometer. Work loads up to one horsepower can be accommodated. The ergometer was calibrated using a dynamometer and speed reducer. The LBNP chamber is fully collapsible and employs circumferential rings to support the side loads. For ground applications longitudinal support members are used to carry the axial loads. The waist seal is a single molded unit and is removable from the chamber. The chamber has provisions for 19 leads of bioinstrumentation. A fail-safe overpressure control system is provided. A design limit of −80 mm Hg for 15 minutes was demonstrated. Normal operating pressure is −30 mm Hg. Provisions were made to integrate the ergometer with the LBNP. The two systems were designed to be operated individually, separately, or simultaneously, and in either the vertical or horizontal mode. Development needs were identified for future investigations. The major areas requiring further study are: generator design, weight reduction material analysis and flight version design. Author (TAB)

N67-21608# Sandia Corp., Albuquerque, N. Mex.
PHYSICAL CHEMISTRY OF CLEANING
G. L. Krieger et al Sep. 1966 118 p refs
(Contract AT(29-1)-789)
(SC-TM-66-428) CFSTI: HC $3.00/MF $0.65

The effects of contaminants on the properties of materials important to electronic devices and to related vacuum processes are discussed. Modern methods of achieving, testing for, and maintaining cleanliness are described. NSA

N67-21712# Army Limited War Lab., Aberdeen Proving Ground, Md.
VENTILATED FLIGHT SUIT Final Report
Frederic G. Hardenbrook Dec. 1966 17 p
(TR-66-07; AD-644811) CFSTI: HC $3.00/MF $0.65

The purpose of this development is to increase the efficiency of the pilot and co-pilot of the Mohawk aircraft when operating in hot climates by using the principle of evaporative cooling. To do so, a Ventilated Flight Suit was developed through which ambient air could be forced by using a small blower and flexible tubing conducting the ambient air to the suit using the perspiration of the individual to achieve the cooling. Service Tests made in South Vietnam proved the Ventilated Flight Suit inadequate when the aircraft cooling system was not in operation unless a supplementary lightweight, portable cooling system is provided. TAB

N67-21716# TRW Systems, Redondo Beach, Calif. Quantum Physics Lab.
PHOTOCHROMIC EYE-PROTECTIVE DEVICE BASED ON TRIPLET ABSORPTION Annual Research Report, 1 Sep. 1965–31 Aug. 1966

Maurice W. Windsor, William R. Dawson, and Richard S. Moore
31 Aug. 1966 106 p refs
(Contract AF 41(609)-2908)
(TRW-05465-6002-R000; Rept.-7; AD-645362) CFSTI: HC $3.00/MF $0.65

A prototype 6 x 8-inch photochromic windshield segment was developed and delivered to the Air Force. The device is designed to protect pilots against flash blindness caused by exposure to nuclear explosions. The reversible photochromic darkening is based upon absorption of visible light by metastable triplet states of aromatic molecules. The active compounds are incorporated into solid sheets of transparent plastic. Three sheets of plastic are arranged in an N-type configuration and the triplet states are produced by UV excitation from two flash lamps. Black glass filters prevent visible light from the flash lamps from dazzling the observer. With a 1900 joule input to the flash lamps, the triplet-state windshield segment attains within one millisecond an optical density, weighted for eye-response, that varies from 1.4 along a line midway between the flash lamps to 2.7 close to each flash lamp. The open-state transmittance is 65% and the device re-opens to one-half this transmittance in approximately 2 seconds.
Author (TAB)

N67-21739# Ohio State Univ., Columbus.
THE EFFECT OF SIMULATED TEAM FEEDBACK ON THE PERFORMANCE OF GOOD AND POOR TRACKERS
William A. Johnston and Leon H. Nawrocki Nov. 1966 12 p refs
(Grant AF-AFOSR-985-66)
(AFOSR-66-2541; AD-644480) CFSTI: HC $3.00/MF $0.65

The effect of partner ability on individual tracking performance was assessed under conditions of simulated team feedback. Each subject was told that he had a partner and that feedback represented his team performance relative to average performance. The average performance criterion was set so that subjects would exceed it on 10%, 30%, 50%, 70%, and 90% of the trials. These levels of criterion difficulty simulated partners of varying ability and each was administered to 14 subjects. As contrived partner ability increased, performance of the better trackers increased steadily, and performance of the poorer trackers first decreased, then increased.
Author (TAB)

N67-21756# National Defense Research Organization TNO, The Hague (Netherlands).
EFFECT OF CHEMICAL DRY CLEANING ON FIRE RESISTANT COMPOSITION OF COTTON OVERALLS FOR PILOTS
28 Jun. 1966 8 p refs
(Rept.-668; TDCK-46046) CFSTI: HC $3.00/MF $0.65

Tests are described in which the fire resistance and shrinkage of three Dutch air force pilot overalls were evaluated after repeated chemical dry cleanings under controlled conditions. The evaluation of the khaki-colored cotton garments was made after 1, 5, and 15 cleanings. One of the overalls was initially clean, one was soiled, and the third, which was not treated for fire resistance, was evaluated for shrinkage. Reagent tablets for timed burning were used in the flame test. After 15 cleanings the fire resistance of the overalls remained fully effective.
Transl. by K.W.

N67-21841# System Development Corp., Santa Monica, Calif.
EXPERIMENTS IN COMPUTER-AIDED INDUCTIVE REASONING
J. R. Newman and M. S. Rogers 6 Dec. 1966 80 p refs
(SDC-TM-3227; AD-645422) CFSTI: HC $3.00/MF $0.65

The document reports on a program of research on human problem-solving behavior when that behavior is being assisted by certain computer and display aids. The research is particularly concerned with problem solving that involves inductive reasoning or concept formation. Previous investigations have indicated that human subjects use a variety of systematic operations when they are solving such problems; one purpose of this project is to carry out an experimental analysis of some of these operations and their explicit uses. To accomplish this purpose, the operations are made available to the problem solver in the form of computer and display aids so that he can call for their implementation quite easily. The problem solver is thus relieved of the burden of actually carrying out the details of the operations. Furthermore, through the complete recording of the use of these computer aids, some aspects of the problem-solving process are externalized for examination by the researcher. The first part of this report outlines the general method and rationale of this work and its relation to other research. The second part describes four specific experiments within that general framework. Groups of subjects were exposed to two major types of concept problems: classification and relational. Those subjects who were allowed to use the computer and display aids (called symbol manipulation functions) in solving the problems achieved significantly higher performance than non-aided subjects. The aids increased in usefulness with problem difficulty and had their greatest utility for the relational problems, which proved to be considerably more difficult than classification problems.
Author (TAB)

06 CHEMISTRY

Includes chemical analysis and identification (e.g., spectroscopy). For applications see: 17 Materials, Metallic; 18 Materials, Nonmetallic; and 27 Propellants.

N67-20405# Los Alamos Scientific Lab., N. Mex.
THE SOLUBILITIES OF SELECTED ELEMENTS IN LIQUID PLUTONIUM. IX: VANADIUM
D. F. Bowersox and J. A. Leary 18 Nov. 1966 11 p refs
(Contract W-7405-ENG-36)
(LA-3594) CFSTI: HC $3.00/MF $0.65

The solubility of V in liquid Pu was measured over the temperature range from 700 to 1000°C. The solubility increased from 0.22% V (by weight) at 700°C to 0.98% V at 1000°C. The data fit the equation $\log N_V = 0.804 - 2.74 \times 10^3\ T^{-1}$, where N_V is the solubility expressed as the mole fraction and T is the temperature in degrees Kelvin.
Author (NSA)

N67-20418# Aerojet-General Corp., Azusa, Calif.
SYNTHESIS OF FOODSTUFFS FROM SIMPLE INORGANIC MATERIALS
S. D. Rosenberg and G. A. Guter *In* NASA 2d Ann. Meeting of the Working Group on Extraterrest. Resources [1964] p 69–74 refs (See N67-20412 10-30) CFSTI: HC $3.00/MF $0.65

An initial research program for the development of nonanimate chemical methods for the conversion of carbon dioxide into foodstuffs is outlined. The specific syntheses recommended for study are 1) the preparation of alcohols by the catalytic reduction of carbon dioxide with hydrogen using Fischer–Tropsch techniques, 2) the preparation of amino acids by the catalytic reduction of carbon dioxide with hydrogen and ammonia using a modified Strecker synthesis, and 3) the preparation of carbohydrates from carbon dioxide and hydrogen using formaldehyde as the key intermediate. The research is an outgrowth of a program concerned with the synthesis of oxygen from lunar resources and is based, in part, on excellent experimental results.
Author

N67-20482 Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE PREPARATION OF REPRODUCIBLE MONODISPERSE AEROSOLS WITH A MEAN PARTICLE RADIUS FROM 30 TO 300 A
A. G. Sutugin *In its* Colloid J. (Selected Articles) 29 Jul. 1966 p 1–3 refs (See N67-20481 10-23) CFSTI: $3.00

The production of monodisperse uncharged aerosols of dioctyl sebacate (DOS) is described. The sodium chloride aerosol used had a mean particle radius of 17A, and the size and particle distribution by size were determined by the diffusion method. The reproducibility of aerosol concentration was determined by the reproducibility of nuclei concentration and was 3%. It is stated that particle dimensions did not change for days (with a measurement accuracy of 2%). R.Li.

N67-20493# Vanderbilt Univ., Nashville, Tenn.
THE EFFECT OF COORDINATION ON THE REACTIVITY OF AROMATIC LIGANDS Final Report, 1 May 1960–31 Aug. 1966
M. M. Jones [1966] 6 p refs
(Grant DA-ARO(D)-31-124-G490)
(AROD-2659-6; AD-642852) CFSTI: HC $3.00/MF $0.65

A brief summary is given of studies which resulted in a fairly complete delineation of the manner in which coordination affects the reactivity of a typical aromatic ligand toward electrophilic reagents. A list of the publications resulting from the work is included. TAB

N67-20501# Western Ontario Univ., London. Dept. of Chemistry.
RESEARCH ON METAL MERCAPTIDES Final Report, 1 Oct. 1960–31 Mar. 1965
D. C. Bradley May 1966 68 p refs
(Contract Nonr-3325(00))
(AD-642139) CFSTI: HC $3.00/MF $0.65

CONTENTS:

1. RESEARCH ON METAL MERCAPTIDES D. C. Bradley 17 p refs (See N67-20502 10-06)
2. THE POLYMERIC STRUCTURE OF MERCURY METHYL MERCAPTIDE D. C. Bradley and N. R. Kunchur 1 p refs (See N67-20503 10-06)
3. STRUCTURES OF MERCURY MERCAPTIDES. I: X-RAY STRUCTURAL ANALYSIS OF MERCURY METHYLMERCAPTIDE D. C. Bradley and N. R. Kunchur 4 p refs (See N67-20504 10-06)
4. STRUCTURES OF MERCURY MERCAPTIDES. PART II: X-RAY STRUCTURAL ANALYSIS OF MERCURY ETHYLMERCAPTIDE D. C. Bradley and N. R. Kunchur 7 p refs (See N67-20505 10-06)
5. METAL MERCAPTIDES. PART I: TITANIUM TETRAMERCAPTIDES AND DIALKYLAMINOTITANIUM (IV) MERCAPTIDES D. C. Bradley and P. A. Hammersley 25 p refs (See N67-20506 10-06)
6. MERCAPTIDES OF COBALT, NICKEL, COPPER AND ZINC D. C. Bradley and C. H. Marsh 5 p (See N67-20507 10-06)

N67-20502# Western Ontario Univ., London. Dept. of Chemistry.
RESEARCH ON METAL MERCAPTIDES
D. C. Bradley *In its* Res. on Metal Mercaptides May 1966 17 p refs (See N67-20501 10-06) CFSTI: HC $3.00/MF $0.65

X-ray diffraction analysis was carried out on some mercury mercaptides, and the preparation of mercaptides of cobalt, nickel, copper, and zinc was investigated and their physico-chemical properties studied. Mercaptides of titanium were also prepared to compare the properties of a d^0 metal mercaptide with those of the mercaptides of d^6, d^7, d^8, and d^{10} metal ions. The tendency for metal mercaptides to be coordination polymers due to bridging by mercaptide groups was also investigated. All the compounds studied proved to be coordination polymers and illustrated the tendency of mercaptide groups to act as bridging ligands. The work also revealed striking contrast in chemical reactivity and thermal stability between mercaptides of different metals. The hydrolytic instability of titanium (IV) mercaptides emphasized the greater affinity of the d^0 metal ion for oxygen-containing ligands rather than sulfur-containing ligands. With regard to thermal stability, it was seen that the d^{10} metal ions, e.g., Cu(I), Zn(II), and Hg(II), form the most stable mercaptides. L.E.W.

N67-20503# Western Ontario Univ., London. Dept. of Chemistry.
THE POLYMERIC STRUCTURE OF MERCURY METHYL MERCAPTIDE
D. C. Bradley and N. R. Kunchur *In its* Res. on Metal Mercaptides May 1966 1 p refs Repr. from Chem. Ind. (London), 1962 p 1240–1241 (See N67-20501 10-06) CFSTI: HC $3.00/MF $0.65

The crystal structure of mercury methyl mercaptide $Hg(SCH_3)_2$ was investigated and the results are reported. Rotation and Weissenberg photographs of the orthorhombic crystals obtained from ethanolic solution gave the unit dimensions. By means of systematic absences the space group was uniquely determined as Pbca. Intensity data were obtained using the multifilm technique. The structure was solved from the (001) and (010) projections. Coordinates of the mercury atoms were obtained by Patterson synthesis and the (001) and (010) Fourier projections were computed by taking the signs given by the positions of the mercury atoms. The positions of carbon and sulfur atoms were determined by difference Fourier analysis and finally the positions of all atoms except hydrogens were refined by successive Fourier syntheses. The structure appears to be polymeric and the next nearest sulfur atoms around each mercury may be sufficiently close to be of stereochemical interest. Attmpts to determine molecular weight and volatility are also briefly discussed. L.E.W.

N67-20504# Western Ontario Univ., London. Dept. of Chemistry.
STRUCTURES OF MERCURY MERCAPTIDES. I: X-RAY STRUCTURAL ANALYSIS OF MERCURY METHYLMERCAPTIDE
D. C. Bradley and N. R. Kunchur *In its* Res. on Metal Mercaptides May 1966 4 p refs Repr. from J. Chem. Phys., v. 40, no. 8, 15 Apr. 1964 p 2258–2261 (See N67-20501 10-06) CFSTI: HC $3.00/MF $0.65

The structure of crystalline $Hg(SCH_3)_2$ has been determined by X-ray diffraction analysis. The dimensions of the unit cell are: a=19.80 Å; b=7.58 Å; c=7.80 Å. There are eight formula units per unit cell and the space group is D_{2h}^{15}, Pbca. The packing of the simple formula units in the crystal suggests the compound is a coordination polymer involving weak mercaptide bridges. Each mercury has two closest sulfur atoms with Hg–S=2.36 Å and three sulfurs with Hg–S=3.26 Å, comprising an irregular tetragonal pyramidal configuration. Author

N67-20505 Western Ontario Univ., London. Dept. of Chemistry.
STRUCTURES OF MERCURY MERCAPTIDES. PART II: X-RAY STRUCTURAL ANALYSIS OF MERCURY ETHYLMERCAPTIDE
D. C. Bradley and N. R. Kunchur *In its* Res. on Metal Mercaptides May 1966 7 p refs Repr. from Can. J. Chem. (Ottawa), v. 43, 1965 p 2786–2792 (See N67-20501 10-06) CFSTI: HC $3.00

The unit cell parameters for $Hg(SC_2H_5)_2$ were determined by X-ray diffraction: a=7.54±0.02; b=4.87±0.01; c=23.80±0.04 Å; β=85°. The unit cell contains four formula units, and a complete structural analysis revealed a molecular lattice with insignificant

intermolecular bonding involving mercury and sulfur. Interatomic distances (excluding C—H) were determined. Author

N67-20506 Western Ontario Univ., London. Dept. of Chemistry.
METAL MERCAPTIDES. PART I: TITANIUM TETRAMERCAPTIDES AND DIALKYLAMINOTITANIUM (IV) MERCAPTIDES
D. C. Bradley and P. A. Hammersley 16 May 1966 *In its* Res. on Metal Mercaptides May 1966 25 p refs Submitted for publication (See N67-20501 10-06) CFSTI: HC $3.00
(TR-4)

Reactions of excess mercaptan R'SH (R' = Me, Et, or Pr^i) with titanium dialkylamides ($Ti(NR_2)_4$ (R = Me or Et) gave insoluble non-volatile red titanium tetramercaptides containing strongly addended mercaptan and amine, viz. $Ti(SR')_4$. $(R'SH)_x(R_2NH)_y$ It is suggested that these compounds are polymeric due to mercaptide bridges and that 8-coordinated titanium may be involved. Soluble complexes of the type $Ti(SR')_4.(R_2NH)_x$, where R' = Pr^n or Bu^n, were also obtained. Attempts to prepare titanium tetratert.-butylmercaptide gave products believed to be titanium sulfide tert.-butylmercaptides which on heating gave impure titanium sulfide. Controlled addition of ethylmercaptan or isopropylmercaptan to $(Ti(NR_2)_4$ gave soluble compounds: $Ti(NMe_2)_3SEt$, $Ti(NMe_2)_2(SEt)_2$, $Ti(NMe_2)_3SPr^i$ and $Ti(NMe_2)_2(SPr^i)_2$ which were shown by cryoscopic measurements to be polymeric. Infrared and NMR spectra were also obtained. Author

N67-20507# Western Ontario Univ., London. Dept. of Chemistry.
MERCAPTIDES OF COBALT, NICKEL, COPPER AND ZINC
D. C. Bradley and C. H. Marsh 17 May 1966 *In its* Res. on Metal Mercaptides May 1966 5 p refs Submitted for publication (See N67-20501 10-06) CFSTI: HC $3.00/MF $0.65
(TR-5)

Summary data are given on the preparation and some of the properties of the mercaptides of cobalt, nickel, copper, and zinc, and some of the results are presented in tabular form. L.E.W.

N67-20535# American Cyanamid Co., Stamford, Conn. Central Research Div.
CHEMILUMINESCENT MATERIALS Technical Report, 1 Jul.–31 Aug. 1966
M. M. Rauhut, L. J. Bollyky, D. R. Maulding, R. A. Clarke, B. G. Roberts et al 30 Sep. 1966 79 p refs
(Contract Nonr-4200(00); ARPA Order-299)
(Rept.-06-1432-25-Q13; TR-13; AD-640694) CFSTI: HC $3.00/MF $0.65

Results from a program designed to optimize the operating characteristics of peroxyoxalate chemiluminescent systems are reported. In particular, the effects of oxalate ester structure, fluorescer structure and certain reaction variables on the light capacities and emission lifetimes of such systems are described. A survey of the effects of a large number of additive components on the lifetimes and efficiencies of several oxalate ester chemiluminescent systems provided additives effective for both lifetime control and light capacity improvement. High light capacity systems are now available with lifetimes variable between one minute and 2 1/2 hours. Investigations of reaction products, reaction intermediates, oxalate ester preparation and oxalate ester stability are reported. The structure of a previously reported efficient chemiluminescent material was identified as bis(1-(1H)-2-pyridonyl) glyoxal. Efficient peroxyoxalate chemiluminescence has thus been extended from the ester to the amide series. Author (TAB)

N67-20538# Naval Research Lab., Washington, D. C.
INVESTIGATION OF 1,4-CYCLOHEXANEBIS (METHYLAMINE) AS A REGENERATIVE CARBON DIOXIDE ABSORBENT Final Report
Paul R. Gustafson 25 Aug. 1966 14 p refs
(NRL-6417; AD-643555) CFSTI: HC $3.00/MF $0.65

The alicyclic diamine, 1,4-cyclohexanebis(methylamine), is an efficient regenerative CO2 absorbent. Both the CO2 absorption rate and capacity are equal to that of MEA. The regeneration rate, however, is slightly less. The disadvantages of 1,4-cyclohexanebis(methylamine) as a regenerative CO2 absorbent are formation of a polymeric-type product when saturated with CO2 and an inferior oxidation stability. One advantage of the diamine over MEA is its higher boiling point (ca. 240C compared with 170C). Author (TAB)

N67-20649# RAND Corp., Santa Monica, Calif.
THE THERMODYNAMICS OF THE BERYLLIA/BERYLLIUM-OXYGEN VAPOR SYSTEM
F. J. Krieger Oct. 1966 37 p refs
(Contract AF 49(638)-1700; Proj. RAND)
(RM-5151-PR; AD-644581) CFSTI: HC $3.00/MF $0.65

The purpose of the study is the thermodynamic investigation of beryllia, BeO, over a range of temperatures up to 6000°K and pressures up to 1000 atmospheres. Two sets of equilibrium composition equations are used—one representing a pure gas phase, the other a heterogeneous system of gas and condensed (i.e., solid or liquid) beryllia. The gas phase of the heterogenous chemical system, like the homogeneous gas phase, comprises 15 gaseous beryllium-oxygen species. The results of the computational program are presented in both tabular and graphic form. The latter is a conventional mollier diagram in which specific enthalpy is plotted against specific entropy, with cross plots of temperature, pressure, and molecular weight or moles of condensed beryllia. Author (TAB)

N67-20671# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
CRYSTAL STRUCTURE OF DIBENZOYLFERROCENE
Yu. T. Struchkov 5 Oct. 1966 9 p refs Transl. into ENGLISH from Dokl. Akad. Nauk SSSR (Moscow), v. 110, no. 1, 1956 p 67–70
(FTD-HT-66-500; TT-67-60280; AD-643994) CFSTI: HC $3.00/MF $0.65

X-ray studies indicated that crystalline dibenzoyl ferrocene has the benzoyl groups attached to the ferrocenyl nucleus at the 1 and 2 positions. TAB

N67-20709# Harvard Univ., Cambridge, Mass. Dept. of Chemistry.
NO TITLE Final Report, 1 Oct. 1956–30 Sep. 1966
E. Bright Wilson, Jr. 12 Dec. 1966 15 p refs
(Contract Nonr-1866(14))
(AD-644572) CFSTI: HC $3.00/MF $0.65

A summary is given of experimental and theoretical accomplishments in the following areas: development of double resonance microwave techniques and their application to the testing of quantum number assignments and of relaxation phenomena in gaseous systems; design and application of a modulation type spectrometer which does not utilize the Stark effect; analysis of microwave spectra of molecules having internal rotation and extracting therefrom the barrier to internal rotation; microwave spectroscopy of 63 chemical species, with particular attention given to molecular structure and the effects of vibrational motion; quantum mechanical calculations of energy levels, especially with respect to error bounds to expectation values and to the utilization density matrix methods. A list of the 111 papers generated as a result of the work is included. TAB

N67-20719# Naval Research Lab., Washington, D. C.
FILAMENT-WINDING PLASTICS. PART 4: SYNTHESES, PROPERTIES, AND USES OF M-AMINOBENZYL AMINE (MABA)
J. R. Griffith 25 Oct. 1966 15 p refs
(NRL-6439; AD-644593) CFSTI: HC $3.00/MF $0.65

During research aimed at improving the tensile properties of plastics suitable for filament winding applications, about 100 materials have been examined in various combinations. The majority of the materials offered no outstanding improvements in the properties sought, relative to standard filament winding systems. But one material new to this application, m-aminobenzyl amine or MABA, has been found to impart substantial improvements to two epoxy plastics of the most useful types. MABA may be synthesized readily by catalytic hydrogenation of m-nitrobenzonitrile or m-nitrobenzaldoxime. It is a solid which melts below 40C and may be easily incorporated into epoxy resins. Its unique properties apparently result from the differences in reactivity of the two amino groups, one attached to the benzene ring and the other displaced by a methylene group. MABA and the diglycidyl ether of Bisphenol-A produce a liquid resin system suitable for wet winding, from which plastic of exceptional energy-absorbing capability is obtained. The plastic produced from MABA and an isomer of dicyclopentyl ether diepoxide has an exceptionally high tensile modulus and ultimate tensile strength. This system has convenient properties for the production of preimpregnated glass strands from which filament windings can be fabricated. Author (TAB)

N67-20734# California Inst. of Tech., Pasadena. Gates and Crellin Labs. of Chemistry.
DIFFUSION MODEL OF THE RADIATION CHEMISTRY OF AQUEOUS SOLUTIONS
Aron Kuppermann 21 Sep. 1966 40 p refs Presented at the 3d Intern. Congr. on Radiation Res., Cortina, Italy, Jun. 1966 Submitted for publication *Its* Gates and Crellin Labs. of Chem. Contrib. No. 3433
(Contract AT(04-3)-532)
(CALT-532-5; CONF-660614-6) CFSTI: HC $3.00/MF $0.65

Developments in studies on the radiolysis of aqueous solutions are summarized, and the present state of the diffusion model is analyzed. The results of computer calculations and experiment are also compared. NSA

N67-20736# Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.
DETERMINATION OF IRON IN PLUTONIUM BY EXTRACTION OF THE Fe(II): BATHOPHENANTHROLINE COMPLEX [DOSAGE DU FER DANS LE PLUTONIUM PAR EXTRACTION DU COMPLEXE FeII: BATHOPHENANTHROLINE]
Bernard Pichotin and Philippe Chaseur Jun. 1966 14 p refs In FRENCH
(CEA-R-2969)

A method is described for determining micro quantities of iron in plutonium; by extraction of the iron (II) complex with bathophenanthroline (4,7-diphenyl-1,10-phenanthroline) using hexanol. The reagent was applied to the determination of amounts of iron ranging from 1 to 10 μg in 20 ml of solvent. The determination is made by spectrophotometry at 530 mμ. Other cations present do not interfere. Author (NSA)

N67-20740# Department of National Health and Welfare, Ottawa (Ontario). Radiation Protection Div.
DATA FROM RADIATION PROTECTION PROGRAMS, VOLUME 4, NO. 8
E. R. Samuels et al Aug. 1966 26 p refs
(NP-16325)

Data are presented on radioactivity due to fallout in Canada during July, 1966. Monthly average values for total β activity in atmosphere and precipitation and ^{137}Cs and ^{90}Sr content in milk are compared with values for the previous months in 1965 and 1966. Results are also summarized from environmental monitoring for radioactivity in the environs of Canadian reactors. NSA

N67-20755# California Univ., Berkeley. Lawrence Radiation Lab.
NUCLEAR MAGNETIC RESONANCE STUDY OF WATER EXCHANGE FROM THE FIRST COORDINATION SPHERE OF Gd(III) ION
Robert Marianelli (Ph.D. Thesis) Sep. 1966 92 p refs
(Contract W-7405-ENG-48)
(UCRL-17069) CFSTI: HC $3.00/MF $0.65

The temperature and frequency dependence of the width, $(1/T_2)$, of the O^{17} NMR signal in an aqueous solution of gadolinium ions was studied in the range from 0° to 100°C at 2.000, 4.000, 5.772, and 8.134 Mc. The temperature study at 8.134 Mc was extended to −58°C by means of a H_2O–$HClO_4$ eutectic solution (4.07% $HClO_4$ by weight). The temperature dependence of the O^{17} longitudinal relaxation rate, $(1/T_1)$, of water both in the presence and absence of Gd(III) ion was studied in the range from 0° to 100°C at 8.134 Mc. The temperature dependence of the width, $(1/T_2e)$, of the ESR spectrum of Gd(III) ions in aqueous solutions was studied in the ranges from 20° to 145°C and 20° to 100°C at 9.180 and 24.250 Mc, respectively. The width of the ESR spectrum is interpreted in of the zero field splitting of the gadolinium ion modulated by rotation and inversion of the $Gd(H_2O)^{3+}$ complex. The width of the bulk water O^{17} NMR spectrum is controlled by the rate of transverse relaxation in the first coordination sphere of the Gd(III) ion. This in turn is a result of the scalar coupling and dipole-dipole interactions between the electron spin of the Gd(III) ion and the nuclear spin of the O^{17} nucleus. The ESR results coupled with proton relaxation times in aqueous solution of Gd(III) and the O^{17} NMR results lead to a determination of the rate constant and its temperature dependence for the chemical exchange of bulk water molecules with those in the first coordination sphere of Gd(III) ion. The previously observed anomaly of the high to low magnetic field ratio of the proton transverse relaxation time can be explained by dipole-dipole coupling interrupted by electron spin relaxation as well as tumbling, using Solomon's equations.
Author (NSA)

N67-20767# General Electric Co., Cincinnati, Ohio. Nuclear Materials and Propulsion Operation.
CHEMICAL AND THERMAL STABILITY OF A BeO–BASE FUEL SYSTEM IN AN OXIDIZING ENVIRONMENT
E. A. Aitken, H. C. Brassfield, and P. P. Turner [1966] 28 p refs Presented at the AIME Nucl. Met. Symp. on High Temp. Nucl. Fuels, Delevan, Wis.
(Contract AT(40-1)-2847)
(CONF-661003-8) CFSTI: HC $3.00/MF $0.65

A high-temperature BeO-base fuel system that is essentially thermodynamically stable in any oxidizing gaseous environment, is described. The fuel is a solid solution of UO_2 and Y_2O_3 dispersed in the BeO. The chemistry of the BeO–UO_2–Y_2O_3 fuel system is discussed in terms of oxidation and vaporization kinetics, for both the UO_2–Y_2O_3 solid solution and for the solid solution dispersed in high density BeO. It was observed that the amount of Y_2O_3 necessary to prevent precipitation of U_3O_8 was a function of the O_2 partial pressure. The addition of 33 mole % Y_2O_3 to the UO_2 prevented precipitation of U_3O_8 when the fuel was oxidized in air. However, 70 mole % Y_2O_3 was required to reduce the vapor pressure of UO_3 gas over the UO_2–Y_2O_3 solution by a factor of 10^3 relative to the vapor pressure over U_3O_8. Oxidation of the solid solution was diffusion controlled; 10μ powders were fully oxidized in a few minutes when heated above 500°C.
Author (NSA)

N67-20769# Callery Chemical Co., Pa.
BORON HYDRIDE STUDIES Final Progress Report
M. D. Marshall and R. M. Hunt Oct. 1966 21 p Prepared for Calif. Univ., Livermore, Lawrence Radiation Lab.
(Contract W-7405-ENG-48)
(UCRL-13240) CFSTI: HC $3.00/MF $0.65

The laboratory phase of the preparation and purification of quaternary ammonium octahydrotriborate and dodecahydrododecaborate derivatives prepared from sodium hydride or sodium borohydride and diborane was successfully completed. Process data are presented for the production of one-half-pound batch preparations of tetramethylpiperazinium bis-octahydrotriborate (TMPOT); tetramethylpiperazinium dodecahydrododecaborate (TMPDD); 1,4-dimethyl-1,4-diaziniabicyclo [2.2.2] octane bis-octahydrotriborate (DDBOT); and 1,4-dimethyl-1,4-diaziniabicyclo [2.2.2] octane dodecahydrododecaborate (DDBDD). The process data are amenable for the production of multi-pound quantities of the boron hydrides in pilot plant equipment. Cost estimates and process information for 10-pound quantities of the boron hydrides TMPOT, TMPDD, DDBOT, and DDBDD have been completed. Author (NSA)

N67-20780# Naval Radiological Defense Lab., San Francisco, Calif.
RADIOACTIVITY RELEASE FROM RADIONUCLIDE POWER SOURCES. III: RELEASE FROM PLUTONIUM METAL TO SEAWATER
11 Jul. 1966 45 p refs
(Contract AT(49-5)-2084)
(USNRDL-TR-1050) CFSTI HC $3.00/MF $0.65

The rates and extent of radionuclide release to seawater from various isotopic fuel material were determined to study the behavior of Pu metal in seawater. It was found that Pu metal reacts completely with natural seawater to produce solid reaction products, believed to be plutonium oxide and/or hydroxide, and a gaseous product whose major component is H. The rate at which the reaction occurs is fairly rapid; 90% of a 60-mg sample reacted in less than 5 hr. The mole ratio of reacted Pu to evolved H is unity. The mixture resulting from the reaction of Pu metal with seawater contains a non-uniform distribution of solids, and ionic and complexed species. In order to reproducibly sample this heterogeneous mixture, an experimentally determined sampling procedure must be followed which produces uniform results. In this sampling system Pu in solution is defined as all those species which pass through a 0.45-μ membrane filter (Millipore). The maximum rate at which Pu solid reaction products enter into "solution" in seawater is very slow, approximately 1.5 to 2 μg per day per 50–70 mg of solids in seawater. The driving force of the reaction is toward the complexed forms. Pu solids dissolve. The effect of individual complexing anions on the solubility of the Pu solids was found to be additive. The equilibrium (or maximum) concentration of dissolved Pu in three samples of natural seawater was found to be 67 μg/l. For seawater samples taken at different localities or at different times of the year, deviations from this value can be expected due to differences in the concentrations of complexing anions present. The length of time for attainment of the equilibrium condition varied with mixing conditions. Author (NSA)

N67-20793# Brookhaven National Lab., Upton, N. Y.
THE ETHYLENE POLYMERIZATION FLOW EXPERIMENT AT BROOKHAVEN NATIONAL LABORATORY Progress Report
L. E. Kukacka and M. Steinberg Oct. 1966 20 p
(Contract AT(30-2)-GEN-16)
(BNL-10730) CFSTI: HC $3.00/MF $0.65

A small-scale ethylene polymerization flow experiment was studied to confirm the kinetic data obtained in capsule experiments and to produce sufficient quantities of polymer (up to approximately 1 lb/batch). The experimental procedure consisted of pressurizing the system with the control valve closed, irradiating the gas for a known period of time, removing the ^{60}Co source, and then discharging the polymer through the control valve. Three apparent differences between the capsule and flow experiments were found: ethylene gas purity; holdup in the discharge line and vessel that could cause recirculation of product in the vessel and excessive radiation doses to part of the polymer resulting in crosslinking; and the product discharge line acting as a tubular reactor to produce a material with a broad molecular weight distribution with a very high molecular weight fraction. NSA

N67-20794# Mallinckrodt Chemical Works, Weldon Spring, Mo. Uranium Div.
PURIFICATION OF NATURAL THORIUM SCRAP MATERIALS BY A SOLVENT EXTRACTION PROCESS
E. N. Nelson and W. J. Robertson 31 Oct. 1966 18 p refs
(Contract W-14-108-ENG-8)
(MCW-1512) CFSTI: HC $3.00/MF $0.65

A flow sheet was developed for conversion of the Weldon Spring uranium refinery to a thorium refinery. A successful thorium campaign was conducted in which about 240 tons of thorium was purified. The flow sheet behaved as expected with the exception of the solvent treatment system, which required some change in both process and equipment. Author (NSA)

N67-20834# Los Alamos Scientific Lab., N. Mex.
PRESSURE EFFECT ON THE FORMATION OF COMPOUNDS IN THE Y_2O_3-Al_2O_3 SYSTEM
Shigeharu Naka, Osamu Takenaka, Tadashi Sekiya, and Tokiti Noda [1966] 19 p refs Transl. into ENGLISH from Kogyo Kagaku Zasshi (Tokyo), v. 69, 1966 p 1112–1116
(LA-TR-66-64)

The effect of pressure on the formation of compounds in the Y_2O_3–Al_2O_3 system was examined and the products were compared with those formed under normal pressure. Under normal pressure, garnet of the composition $3Y_2O_3 \cdot Al_2O_3$, and a monoclinic compound were formed most readily. In addition to perovskite, both garnet and a monoclinic compound were found in the products of the composition $Y_2O_3 \cdot Al_2O_3$ when heat treatment was applied at 1500°C (to the raw material). Fusion treatment (of the raw material), however, gave rise to a single phase of perovskite, which partially decomposed at 1500°C after 24 hours to yield a garnet and monoclinic compound. A sample in gel form gave garnet as a major product at 5 kb and 400°C. A sample having more Al_2O_3 than the composition $3Y_2O_3 \cdot Al_2O_3$ does contained boehomite and YOOH (together with garnet), while a sample having more Y_2O_3 (than the composition $3Y_2O_3 \cdot 5Al_2O_3$ does) was found to have YOOH (together with garnet). The lattice constant of garnet produced under high pressure was 12.03 to 12.04 Å, while the lattice constant of garnet formed under normal pressure was 12.004 Å. The high-pressure garnet was probably garnet solid solution of the $(Y_3)\ Y_xAl_{2-x}\text{-}(Al_3)\ O_{12}$ type. This garnet solid solution was stable at 1000°C under normal pressure. Author (NSA)

N67-20837# Atomic Weapons Research Establishment, Aldermaston (England).
THE PERMEATION AND DIFFUSION OF HYDROGEN ISOTOPES THEOUGH STAINLESS STEELS. PART 4: THE DIFFUSION OF TRITIUM THROUGH S110 AND EN58E STEELS AT 80°C
P. M. S. Jones and R. Gibson Sep. 1966 20 p refs
(AWRE-O-58/66) HMSO. 3s

The measured solubility values for these steels were found to be significantly higher than those calculated from high-temperature permeation- and diffusion-coefficient data. The diffusion coefficients, on the other hand, are a factor of 5 to 10 lower than the extrapolated values. Thus the measured and calculated permeation constants at 80°C are lower than the extrapolated values by a factor of approximately four. Reasons for the differences are discussed. NSA

N67-20867# Iowa State Univ., of Science and Technology, Ames.
STABILITY CONSTANTS OF RARE EARTHS WITH SOME WEAK CARBOXYLIC ACIDS
Lawrence E. Kovar and J. E. Powell Oct. 1966 54 p refs
(Contract W-7405-ENG-82)
(IS-1450) CFSTI: HC $3.00/MF $0.65

The complex formation constants of species formed by the rare earths, except promethium, with the formate, acetate, chloro-acetate, and iodacetate ligands were determined potentiometrically using a variable K_a. The stability constants were computed via a least squares technique using an IBM 7074 computer at an ionic strength of 0.10 ($NaClO_4$) and a temperature of 25°C. The acetate constants were found to be lower for the heavier rare earths than the light rare earths. The iodoacetate, formate, and chloroacetate constants followed the same general trend as the acetate constants. The halogens contributed little, if any, to the chelate formation with the rare earth ions. Author (NSA)

N67-20901# Cornell Univ., Ithaca, N. Y. Lab. of Atomic and Solid State Physics.
ZERO-PHONON LINE LUMINESCENCE AT COLOR CENTERS IN ALKALI HALIDES
D. B. Fitchen Apr. 1966 8 p refs Submitted for publication
(Contract AT(30-1)-3464)
(NYO-3464-2; CONF-660818-1) CFSTI: HC $3.00/MF $0.65

The necessary conditions for zero-phonon lines in terms of a simple configuration diagram are reviewed. Some narrow lines in emission spectra of color centers in alkali halides are identified and analyzed. Special attention is given to the lines at 8333 Å and 10404 Å in LiF at 4.K. The isotope effect, when ^6LiF instead of ^7LiF is the host lattice, is shown for the 10404 Å line and its one-phonon sideband. NSA

N67-20905# Mallinckrodt Chemical Works, Weldon Spring, Mo. Uranium Div.
ELECTROLYTIC REDUCTION OF URANIUM HEXAFLUORIDE TO URANIUM METAL
R. D. Piper 1 Jul. 1966 7 p refs
(Contract W-14-108-ENG-8)
(MCW-1497) CFSTI: HC $3.00/MF $0.65

Direct reduction of UF_6 to uranium metal was demonstrated on a laboratory scale. Introduction of UF_6 at the graphite anode of a cell operated at 1150°C with a molten BaF_2–LiF–UF_4 electrolyte produced CF_4 at the anode and molten uranium at the cathode. Complete recovery of the UF_6 was obtained. Author (NSA)

N67-20907# New Mexico Univ., Albuquerque. Sandia Corp.,
ELECTROCHEMISTRY OF SOME TRANSITION METALS AND LANTHANIDES DISSOLVED IN MOLTEN ALKALI METAPHOSPHATE Final Report, Jul. 1, 1965–Jun. 30, 1966
Roy D. Caton, Jr. [1966] 113 p refs Prepared for Sandia Corp.
(Contract AT(29-1)-789)
(SC-CR-66-2104) CFSTI: HC $3.00/MF $0.65

The performance of a silver–silver metaphosphate reference electrode was tested with respect to its reproducibility and stability. The average potential observed between two identical reference electrodes was approximately 2 mV. Electrode potential studies were conducted on the Cu(II)/Cu(I), V(V)/V(IV), and U(VI)/U(IV) systems. Plots of potential versus the logarithm of the ratios of the concentrations of the oxidation states were constructed for each system. These plots yielded straight lines in all cases. Chronopotentiometric investigations were conducted on the same solutions employed in the electrode potential studies. The method was found to be analytically useful for the determination of V(V), Ag(I), U(VI), U(IV), Cu(I), and Cu(II) (in the absence of Cu(I)). Provided care is taken in exposing a constant area of the electrode to each solution, the analyses can be performed with an accuracy of better than 3%. NSA

N67-20909# Oak Ridge National Lab., Tenn.
SOL-GEL PREPARATION OF LANTHANIDE-OXIDE MICROSPHERES AND CHARACTERIZATION OF SOLS AND GELS OF LANTHANIDE HYDROXIDES, THORIA, URANIA, AND PLUTONIA
C. J. Hardy 12 Aug. 1966 33 p refs
(Contract W-7405-ENG-26)
(ORNL-TM-1592) CFSTI: HC $3.00/MF $0.65

Laboratory methods have been developed to produce microspheres of lanthanide oxides with a controlled size (50- to 500-μ dia), high density (up to 98% of theoretical crystal density), low surface area (0.01–0.1 m^2/g), and good crushing strength, by using sols and gels of the hydroxides as intermediates. UV, visible, ir, and Raman spectra of sols and gels of lanthanide hydroxides, thoria, urania, and thoria–UO_3 mixtures, were measured to: determine the nature of the bonding between the components, e.g., nitrate and lanthanide ions; obtain rapid analyses for nitrate and lanthanide ions; and determine the size of the colloidal particles by turbidity and light-scattering measurements (both methods gave results in good agreement for thoria sols containing particles of 200 A diameter, but appreciably larger than the crystallite size measured by X-ray linebroadening; the difference may be due to aggregation or to poly-dispersity). Preliminary measurements of the turbidities of plutonia sols were made, and difficulties were experienced in interpreting the results; the particles in one sol appeared to have a diameter of about 640 A and a molecular weight of 9×10^8. Sols and gels of lanthanide hydroxides and urania were examined by electron microscopy and electron diffraction to determine the size, shape, and crystallinity of the colloidal particles at the various stages in th processes to make microspheres of oxides. NSA

N67-20916# Sandia Corp., Livermore, Calif.
THICK NICKEL DEPOSITS OF HIGH PURITY BY ELECTROLESS METHODS
J. W. Dini and P. R. Coronado Jun. 1966 24 p refs Presented at the Symp. on Plating in the Electron. Ind., Am. Electroplaters Soc., Newark, N. J.
(Contract AT(29-1)-789)
(SCL-DC-66-22; CONF-661202-1) CFSTI: HC $3.00/MF $0.65

A method is presented for producing thick, relatively pure Ni deposits by autocatalytic reduction in solutions containing nickel acetate, glycolic acid, a sodium salt of EDTA, and hydrazine. Stability and plating rate were found to be good provided the composition of the solution was kept within certain fixed limits and salts of high purity were used. Experiments showing the optimum formulation and optimum operating conditions are described. Deposits up to ten mils thick with 99% purity were produced. Metallographic examination and X-ray diffraction revealed their structure to be extremely fine grained. Deposits were highly stressed. Hardness in the as-deposited condition was 360 to 500 Knoop; ductility was poor. Heat treatment at 760°C improved ductility markedly and lowered hardness to 85 Knoop. Density also was lowered. Corrosion resistance was inferior to that of deposits produced in electroless hypophosphite baths and electrolytic sulfamate baths. Possible applications of the process are suggested. Author (NSA)

N67-20938# Commissariat a l'Energie Atomique, Fontenay-aux-Roses (France). Centre d'Etudes Nucleaires.
LINEAR CHRONO-AMPEROMETRY USING REDISSOLUTION: APPLICATION TO HALIDES [LA CHRONOAMPEROMETRIE LINEAIRE PAR REDISSOLUTION: APPLICATION AUX HALOGENURES]
Jean-Pierre Perchard (Paris Univ.) Micheline Buvet, and Roger Molina Jun. 1966 76 p refs In FRENCH
(CEA-R-3030)

The possibility of applying linear chronoamperometry to analysis was studied using a falling-drop mercury electrode. Measurements

of the cations were carried out by direct reduction or by prior formation of an amalgam, which is then oxidized. Using the first technique, the minimum concentration that can be attained is about 10^{-6}M and the reproducibility of the results is of the order of 2%. With the second method the sensitivity is much improved: in the concentration range of 10^{-7} to 10^{-8}M, the scatter of the results is less than 10% if the agitation and temperature conditions are kept constant. The halides are determined by redissolving the mercurous halide deposit formed by electrolysis. From the analytical point of view, the sensitivity is limited in the domain where the phenomena can be interpreted and used. In the case of the chloride ion the lower limit of this zone is close to 10^{-5}M; it is 10^{-6}M for the bromide and less than 10^{-7}M for the iodide. For lower concentrations, simple laws that might be applied in analysis are no longer valid. However, the splitting of the peak observed during the reduction of the mercurous iodide deposit was interpreted as showing that the mono-molecular Hg_2I_2 layer formed on the drop has particular electrochemical properties. Author (NSA)

N67-20975# Brookhaven National Lab., Upton, N. Y.
SOME GENERAL PRINCIPLES IN THE RADIATION CHEMISTRY OF ORGANIC COMPOUNDS
Donald J. Metz [1966] 26 p refs Presented at the Nederlands Atoomforum Conf., Utrecht
(Contract AT(30-2)-GEN-16)
(BNL-10592; CONF-660312-8) CFSTI: HC $3.00/MF $0.65

The similarities and differences between radiation chemistry and photochemistry are discussed, along with results obtained from two different methods for studying the radiation chemistry of organic compounds. The identification of intermediates, as studied by vinyl polymerization, is also considered. NSA

N67-21006# Du Pont De Nemours (E. I.) and Co., Aiken, S. C. Savannah River Lab.
PRODUCTION OF THALLIUM-204 FROM THALLIUM OXIDE
Wilmer R. Cornman Jun. 1966 10 p refs
(Contract AT(07-2)-1)
(DP-1033) CFSTI: HC $3.00/MF $0.65

A sample of natural Tl_2O_3 was irradiated. The specific activity and power density of the irradiation product were in good agreement with the predicted values. A specific power value of 0.00164 watt/curie of ^{204}Tl was obtained from radiometric and calorimetric measurements. Author (NSA)

N67-21019# European Atomic Energy Community, Ispra (Italy). Chemistry Dept.
PREPARATION OF URANIUM CARBIDES AND MIXED (URANIUM–ZIRCONIUM) CARBIDES BY DIRECT CONVERSION OF HALIDES [PREPARATION DES CARBURES D'URANIUM ET DES CARBURES MIXTES (URANIUM–ZIRCONIUM) PAR CONVERSION DIRECTE DES HALOGENURES EN CARBURES]
P. Baucherie, M. Payrissat, and J. G. Wurm Brussels, EURATOM, Nov. 1966 54 p refs In FRENCH; ENGLISH summary
(EUR-3170.f) CFSTI: HC $3.00/MF $0.65

The direct conversion of halides to carbides has been investigated by the following series of reactions: carburization reactions of uranium halides (chlorides or fluorides) with a mixture of graphite and reducing metal (Mg, Ca, Al); carburization reactions of fluorides mixtures (uranium and zirconium) with a reducing metal and graphite in order to form polycarbides. Both reaction series have been investigated for their criteria of product quality and efficiency. The reactions of carburization are initiated under inert atmosphere at normal pressure, once the carbide is formed, the excess of the reducing metal and its halide are driven off under vacuum. The described method has following important applications: production of enriched uranium carbide, preparation of polycarbides, as a complementary tail end process for halide volatility reprocessing purposes. Author

N67-21036# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
A MULTIPHONON NEUTRON SCATTERING STUDY OF HYDROGEN BONDING IN ZIRCONIUM HYDRIDE
O. K. Harling and B. R. Leonard, Jr. *In* Brookhaven Natl. Lab. Inelastic Scattering of Neutrons by Condensed Systems Mar. 1966 p 96–104 refs (See N67-21022 10–24) CFSTI: HC $3.00/MF $0.65

The Battelle rotating-crystal spectrometer has been used to investigate the hydrogen bonding in a sample of ZrH. Scattered neutron spectra were obtained at scattering angles of 15° to 165° for incident energies of 0.504, 0.386, and 0.180 eV. The over-all resolution on energy changes was from 4% to about 20% for neutrons scattered from the first three vibration levels. The observed energies and widths of the first three levels were found to be 141.4±3, 280.9±8, 411±9, and 26.4±0.6, 52.2±3.7, 72±6 meV, respectively. Resolution corrections have been applied to these energy widths. The angular distributions of elastic scattering and of the inelastic scattering from the first three vibration levels were compared with theory, assuming that the hydrogen atom is bound in an isotropic harmonic potential well. The experimental elastic scattering distributions agreed with theory to within ±1% to ±6%. For all incident energies the angular dependence of the total scattering associated with each vibrational level agreed with theory to from ±9% to ±23%. On the basis of these results it appears that the assumption of harmonic bonding for the first three levels in ZrH is a good first approximation. Author (NSA)

N67-21061 Kernforschungsanlage, Juelich (West Germany). Institut fuer Radiochemie.
THE CHEMICAL REACTION PRODUCTS OF $^{191}IR(n,\gamma)^{192}Ir$ NUCLEAR REACTION IN Ir-IV-HEXACHLOROCOMPLEXES, THEIR IDENTIFICATION AND THEIR ROLE IN THERMAL AND GAMMA RAY CURING [DIE CHEMISCHEN FOLGEPRODUKTE DER $^{191}Ir(n,\gamma)$ ^{192}Ir-CERNREACTION IN Ir-IV-HEXACHLOROKOMPLEXEN, IHRE IDENTIFIZIERUNG UND IHRE ROLLE BEI DER THERMISCHEN UND GAMMASTRAHLENAUSHEILUNG]
Rita Bell Sep. 1964 97 p refs In GERMAN
(JUL-181-RC) CFSTI: $3.00

Reported is the electrophoretic separation of 13 individual reaction products of the system $Na_2IrCl_6 \cdot 6\ H_2O$ that formed through the nuclear process of $^{191}Ir(n,\gamma)^{192}Ir$ activation in the individual components was studied by hydrolyses and ^{192}Ir and ^{36}Cl tracer motion velocities. Chemical identification of individual components in the reduction Ir-IV to Ir-III found two hexachloro compounds of Ir-III and Ir-IV, as well as the mono-, di-, and triaqua compounds of the Ir-III-hexachloro complex. Results of $^{191}Ir(n,\gamma)^{192}Ir$ nuclear reaction in dehydrated $K_2IrCl_6^-$ and $(NH_4)_2IrCl_6$ showed unstable intermediates. Thermal and gamma radiation curing of $Na_2IrCl_6 \cdot 6\ H_2O$ resulted in the readmission of the earlier escaped Cl into the ligand. In general, curing of link components containing few Cl groups increased their Cl content; Cl could take the place of the H_2O as well as the OH group. The presence of crystal water necessitated a higher gamma dosage of 100 Mrad for visible curing effects. Transl. by G.G.

N67-21065# Kernforschungsanlage, Juelich (West Germany). Institut fuer Radiochemie.
ON THE CHEMISTRY OF NUCLEONIC CARBON ATOMS [ZUR CHEMIE NUKLEOGENER KOHLENSTOFFATOME]
Gerhard Stoecklin (Brookhaven Natl. Lab.) Jul. 1965 104 p refs In GERMAN Supported in part by AEC
(JUL-228-RC) CFSTI: HC $3.00/MF $0.65

Reaction mechanisms of ^{11}C recoil atoms with simple aliphatic and alicyclic hydrocarbons, with oxygen, and with methyl

amine in the gaseous as well as liquid phase were studied. ^{11}C atoms were obtained by nucleation marked reaction products were identified by gas chromatography and quantitatively determined. A major product of all investigated hydrocarbons was acetylene-C-11. Structural and deuterium-isotopic analyses found that acetylene-C-11 was formed exclusively with the "empty" ^{11}C atoms.
Transl. by G.G.

N67-21102 International Faculty of Mental Sciences, Haarlem (Netherlands).
INDUSTRIAL SCALE MANUFACTURE OF PURE FLUIDIC DEVICES FROM ACRYLIC MATERIAL BY A SPECIAL CASTING PROCESS
Otto F. Joklik 1967 6 p Presented at the 2d Cranfield Fluidics Conf., Cambridge, England, 3–5 Jan. 1967 Paper F5
CFSTI: $3.00

One of the major problems in the divulgation of pure fluidic technology is the difficulty of obtaining satisfactory results in large scale industrial manufacture of pure fluidic elements and systems at low production cost. Particular attention is given to plastic materials which appear to be ideal for the industrial manufacture. As particularly suitable has proven to be methylmethacrylate polymer, relatively easily obtainable by radical polymerization of the monomer. The classic polymerization method of pouring the liquid monomer into a sandwich mold with subsequent thermic polymerization has been utilized and improved to achieve a uniform thermic polymerization in a large scale industrial production of pure fluidic elements. This improved method consists in manufacturing a pure fluidic element from two cast plates of methylmethacrylate polymer, the one being plain, the other having incorporated the inner structure of the element and the polymerization being induced by a particular catalyst and a particularly hard and resistant surface being obtained by a co-polymerization with another monomer, the two components of the element being finally coated together.
Author

N67-21144 Argentina. Comision Nacional de Energia Atomica, Buenos Aires.
CALIBRATION OF ^{95}Zr–^{95}Nb MIXTURES BY GAMMA SPECTROMETRY [CALIBRACION DE MEZCLAS DE ^{95}Zr–^{95}Nb POR ESPECTROMETRIA GAMMA]
Elma A. A. Tenreyro 1966 15 p refs In SPANISH; ENGLISH summary
(CNEA-177) CFSTI: $3.00

A routine method for the calibration of ^{95}Zr–^{95}Nb by gamma spectrometry is proposed. The absolute activities are obtained by using conversion factors of the counting rate into the disintegration rate. The method of determining these factors for the nuclides is given, and it is necessary to know the time when the ^{95}Zr becomes free of ^{95}Nb. The time for one complete analysis is less than one hour.
R.Ll.

N67-21145 Argentina. Comision Nacional de Energia Atomica, Buenos Aires.
DETERMINATION OF STABILITY COEFFICIENTS OF COMPLEXES. II: INDIRECT MEASUREMENT OF FREE METAL CONCENTRATION APPLIED TO BERYLLIUM–ACETATE COMPLEXES
Carlos Bamberger and Antonio Suner 1966 21 p refs In SPANISH
(CNEA-191) CFSTI: $3.00

Three methods are described for calculating the coefficients of formation from the indirect measurement of ionic exchange resins. The value of the coefficients of formation of acetate–beryllium complexes were necessary for application to the use of acetoacetate acids in a study of the effect of other ligands. A mathematical description, followed by technical details of the experiment, is presented. A comparison of various experimental results was made to determine whether or not the $BeAc^+$ remains in the resin.
Transl. by R.Ll.

N67-21146 Argentina. Comision Nacional de Energia Atomica, Buenos Aires.
ANALYTIC CHROMATOGRAPHY WITH LOW PRESSURE ELECTRICAL DISCHARGE DETECTORS [CROMATOGRAFO ANALITICO CON DETECTORES DE DESCARGA ELECTRICA A BAJA PRESION]
R. Bonard, L. Cannavale, C. Noutary, and G. Videla 1966 16 p refs In SPANISH Presented at the 9th Latin Am. Chem. Congr., San Juan, Puerto Rico, Aug. 1965
(CNEA-180) CFSTI: $3.00

The principal technical characteristics of gas phase chromatography using low-gas pressure, electrolytic detectors are presented. For all types of gas and vapors, these electrodes are highly sensitive (on the order of 10^{-11} mol), and are therefore particularly suited for special studies such as the isotopic separation of water–heavy water, and the solubility of gases in metals. Among other factors considered in their construction were: the hermeticity of the gas circuit, the inalterability of the electrodes, the conditions to ensure stability of functioning, and the existence of low-level electric noise. Pertinent details and graphics of experiments showing the high sensitivity, reproducibility, and fast action of the apparatus are included.
Transl. by R.Ll.

N67-21147 General Electric Co., Philadelphia, Pa. Missile and Space Div.
PREPARATION OF BORON FILAMENTS ON FUSED SILICA SUBSTRATES BY DECOMPOSITION OF DIBORANE
R. B. Reeves and J. J. Gebhardt Aug. 1966 13 p refs Presented at 10th Natl. SAMPE Symp., San Diego, Calif., 9–11 Nov. 1966
(R66SD45; AD-488339)

Preparation of boron filaments by the thermal decomposition of diborane can be effected at temperatures sufficiently low to permit the use of an inorganic, i.e., glass substrate such as silica, thus avoiding the need for the high temperature metallic substrate, (e.g., tungsten) required by the boron trichloride–hydrogen system. Although the chemistry of diborane is more complicated and side polymerization reactions can adversely affect filament properties, it is possible to obtain satisfactory filaments on silica substrates at temperatures around 700°C. Process studies were carried out using dilute mixtures (up to 2%) of diborane in argon at one atmosphere and pure diborane at about .03 atmosphere. The effects of temperature, concentration, reactor geometry and filament speed were investigated with regard to pertinent filament properties, i.e., tensile modulus, tensile strength and density. The primary goal was to achieve sufficiently high deposition rates to permit the process to be economically feasible without compromising filament properties. The results of the process study showed that although filaments of good quality (tensile modulus difference between 50 million psi, tensile strength difference between 200,000 psi) can be made from dilute diborane mixtures on a silica substrate, the deposition step is diffusion limited. Steps taken to increase the rate of deposition under these conditions have only a moderate effect on the rate, but increase the rate of polymerization side reactions with consequent degradation of filament properties. At low pressure, deposition rates are about ten times faster and the process is surface reaction rate limited.
TAB

N67-21165# Commissariat a l'Energie Atomique, Cadarache (France). Centre d'Etudes Nucleaires.
NEUTRON SPECTROMETRY IN A NATURAL-URANIUM ASSEMBLY BY MEANS OF THE $^6Li(n,t)^4He$ REACTION USING SURFACE-BARRIER JUNCTIONS [SPECTROMETRIE DES NEUTRONS DANS UN MASSIF D'URANIUM NATUREL AU MOYEN DE LA REACTION $^6Li(n,t)^4He$ A L'AIDE DE DETECTEURS A BARRIERE DE SURFACE]
Ghislaine De Leeuw-Gierts and Seraphin De Leeuw (Centre d'Etude de l'Energie Nucl.) Brussels, EURATOM, Dec. 1966 34 p refs In FRENCH; ENGLISH summary
(Contract EURATOM-006-62-1 RAAF)
(EUR-3061.f; CEA-R-3038) CFSTI: HC $3.00/MF $0.65

The data from two measurement-series on a natural uranium assembly are presented. The stability and reproducibility of E_γ distribution measurements were confirmed. In the second series background noise was eliminated. A preliminary study of the data made it possible to define the energy range analyzed; it is seen to cover the entire low-energy field. Author

N67-21156# Argentina. Comision Nacional de Energie Atomica, Buenos Aires.

SEPARATION BY CHROMATOGRAPHY INTO THIN LAYERS OF SOME MIXTURES OF 2,4-DINITROPHENYLHYDRAZONES OF CETONES OBTAINED BY THE PYROLYSIS OF SALTS [SEPARACION POR CROMATOGRAFIA EN CAPA DELGADA DE ALGUNAS MEZCLAS DE 2,4-DINITROFENILHIDRAZONAS DE CETONAS OBTENIDAS POR PIROLYSIS DE SALES]

Aldo E. A. Mitta and C. P. Mertig 1966 8 p refs In SPANISH (CNEA-195) CFSTI: HC$3.00/MF$0.65

In laboratory studies on the pyrolysis of various carboxylic acids, a mixture of ketones was obtained as a reaction product. In order to identify ketones in such mixtures, and in order to separate quantities greater than those obtained by classical methods, thin layer chromatographic techniques were employed in columns of 2,4 dinitrophenylhydrazone. Analytical results of the separation of ketones obtained by pyrolysis of lithium carboxylates are presented. Transl. by R.U.

N67-21209# Kernforschungsanlage, Juelich (West Germany). Institut fur Physikalische Chemie.

STANDARDIZATION OF ALPHA-EMITTERS BY LIQUID-SCINTILLATION COUNTING

H. R. Ihle, A. P. Murrenhoff, and M. Karayannis Sep. 1966 13 p refs Presented at the I.A.E.A. Symp. on the Standardization of Radionuclides, Vienna, 10–16 Oct. 1966

(JUL-411-PC; SM-79/2) CFSTI: HC$3.00/MF$0.65

Internal liquid scintillation counting allows a high precision in the standarization of solutions of α-emitting nuclides. The method has a number of advantages: under appropriate experimental conditions, a 4π geometry is obtained; the difficulties with sample self-absorption and backscattering often encountered in methods necessitating mounting of the samples on plates are eliminated. One condition of particular importance is the stability of the liquid scintillation sources over long periods of time. Measurements with actinide-nuclides from thorium to curium showed that the ions of the actinides can be stabilized by means of tri-n-octyl-phosphineoxide, which simultaneously acts as complexing agent and counteracts the quenching effects of acids. A technique for the comparison of liquid scintillation counting with other absolute counting methods, which avoids the possible sources of errors from weighing or pipetting of aliquots, has been developed and verified. The method was applied to new determinations of the specific activity of ^{239}Pu and ^{233}U with an accuracy of $\pm 0.3\%$ and $\pm 0.2\%$ respectively. In the liquid scintillation counting a precision of $\pm 0.05\%$ was obtained. Author

N67-21211# Atomic Energy of Canada, Ltd., Chalk River (Ontario).

THE RADIOLYSIS OF ORTHO-TERRHENYL META-TERPHENYL. III: WITH A MIXTURE OF FAST NEUTRONS AND GAMMA RAYS AT A DOSE RATE OF 1 WG-1

A. W. Boyd and H. W. J. Connor Nov. 1966 11 p refs (AECL-2655) CFSTI: HC$3.00/MF$0.65

Samples of ortho- and meta-terphenyl have been irradiated at temperatures from 110 to 450°C in an annular uranium rod in a lattice position in NRX reactor. The total energy deposition rate in the samples, consisting of equal contributions from fast neutrons and γ-rays, was 1 Wg^{-1}. Over this temperature range the G values for the disappearance of ortho-terphenyl increased from 0.4 to 1.5 instead of ≈ 4 as observed at 0.1–0.3 W g^{-1}. G values for meta-terphenyl disappearance at 1 Wg^{-1} from 225 to 420° increased from 0.47 to 0.56 instead of 0.9 at the lower dose rates. The G values for higher boiler formation at 1 Wg^{-1} showed even less temperature dependence than disappearance G values. A mechanism to explain these results is proposed. Author

N67-21214# Kernforschungsanlage, Juelich (West Germany). Institut fur Chemische Analyse.

THE STUDY OF IRREVERSIBLE ELECTRODE PROCESSES BY MODERN INSTRUMENTAL METHODS

G. C. Barker, H. W. Hurnberg, and J. A. Bolzan Sep. 1963 32 p refs Presented at the 14th CITCE Meeting, Moscow, 1963

(JUL-137-CA) CFSTI: HC$3.00/MF$0.65

The potentialities of advanced methods applied to totally irreversible processes such as the reduction of the hydrogen ion on mercury are discussed. Three techniques are presented for the study of irreversible electrode processes. For the lower range of rate constants the pulse polarography method is employed. In the medium range supporting measurements were made by square-wave polarography. On the upper side some further extension use of a single pulse method related to the high level faradaic rectification method is considered. Due to the benefits arising from the combination of a charge injection technique with faradaic rectification, this method presently has the greatest potentialities for determining large homogeneous and heterogeneous rate constants. Problems involved in determining the kinetics of electrode processes are also examined. S.P.

N67-21217# Kernforschungsanlage, Juelich (West Germany). Institut fuer Physikalische Chemie.

THE COUNTING OF PLUTONIUM ISOTOPES WITH A LIQUID SCINTILLATOR. THE AVOIDANCE OF ERRORS DUE TO WALL-ADSORPTION OF THE PLUTONIUM [ZAEHLUNG VON PLUTONIUM-ISOTOPEN MIT FLUESSIGSZINTILLATOREN. VERMEIDUNG VON FEHLERN, DIE VON EINER WANDADSORTION DES PLUTONIUM HERRUEHREN]

H. Ihle, A. Murrenhoff, and H. Aulich Jul . 1963 15 p refs In GERMAN; ENGLISH summary

(JUL-127-PC) CFSTI: HC$3.00/MF$0.65

Tri-n-octylphosphineoxide (TOPO) has been found to be a suitable non-quenching complexing agent for application to internal liquid scintillation of Pu eliminating the errors due to chemical wall-adsorption of hydrolized species of Pu-ions. The excellent light yield and transmission properties of the (Dioxan-PPO-POPOP-Naphthalene-TOPO) liquid scintillator allow the use of conventional counting equipment as normally used with ZnS and NaJ scintillation crystals. With such equipment counting plateaus with a slope of less than 0.1% per 100 V over the best range are readily obtained. With low noise equipment excellent precision for absolute alpha-counting can be achieved. The scintillator mixes with samples of aqueous Pu-solutions containing considerable quantities of salts and with samples of organic Pu-solutions containing organic complexing agents of low volatility. Both these types of samples cause difficulties for counting plate techniques due to self-absorption. The liquid scintillation method described is therefore especially favorable in the analytical evaluation of solvent extraction experiments. Author

N67-21264# Israel Program for Scientific Translations, Ltd., Jerusalem.

RADIOACTIVE INSPECTION OF HOMOGENEITY OF CERMET REFERENCE SPECIMENS USED IN THE SPECTROSCOPIC ANALYSIS OF PRECIOUS METALS

S. M. Klotsman, A. A. Kuranov, V. D. Ponomareva, and A. N. Timofeev *In its* The Uses of Radioact. Isotopes and Nucl. Radiation in the U.S.S.R. Vol. III: Machine Bldg., Met. 1966 p 190–192 (See N67-21221 10-15) CFSTI: HC$3.00/MF$0.65

Cermet reference specimens used for the spectroscopic analysis of precious metals were subjected to radioactive inspection. Iridium 192 and phosphorus 32 were used to determine the

homogeneity of these specimens prepared from sintered metal powders. Optimum blending times were established for the powders; and in the case of ideal solubility, or self-diffusion of silver, the sintering time required for homogenization of the specimens was 6 hours at temperatures between 700 and 900°C. M.W.R.

N67-21301# Israel Program for Scientific Translations, Ltd., Jerusalem.

RADIOACTIVATION (PHOTONEUTRON) METHOD FOR THE DETERMINATION OF BERYLLIUM

Kh. B. Mezhiborskaya *In its* The Uses of Radioactive Isotopes and Nucl. Radiation in the U.S.S.R., Vol. 4 1966 p 171–174 (See N67-21281 10-13) CFSTI: HC $3.00/MF $0.65

To eliminate self-absorption of neutrons in the sample, an apparatus was developed in which neutrons are recorded by a commercial instrument in conjunction with a special unit for the irradiation of samples and the moderation of the generated neutrons. The gamma source is Sb^{124} (half-life 60 days), in the shape of an antimony rod in an aluminum casing; the mean activity is 100 mc. In the analysis, relative measurements of the count rate for pulses from the sample and from a suitable standard, irradiated under identical geometric conditions, are used. The principle feature is the use of three techniques for eliminating neutron absorption by harmful components in the sample with high neutron capture cross sections. These are: limited size of sample, extrapolation to zero layer, and internal standard. Graphs are included to depict the relationship between the measured results and the thickness of the sample layer in the presence of harmful components, and the divergence between beryllium determinations by the radioactivation method and by chemical analyses. M.G.J.

N67-21305# Israel Program for Scientific Translations, Ltd., Jerusalem.

THE "NEUTRON" UNIT AND SOME POSSIBILITIES OF ITS APPLICATION TO THE ANALYSIS OF THE ELEMENTARY COMPOSITION OF MINERAL RAW MATERIALS

A. L. Yakubovich and E. I. Zaitsev *In its* The Uses of Radioactive Isotopes and Nucl. Radiation in the U.S.S.R., Vol. 4 1966 p 199–206 (See N67-21281 10-13) CFSTI: HC $3.00/MF $0.65

Descriptive details are presented on a high efficiency apparatus consisting of a scintillation counter of slow neutrons, polonium–beryllium source of low activity (not over 0.01 curie Po), moderator block, and amplifying–recording circuit on semiconductors. The apparatus was developed for neutron analysis of geological samples for several elements. Determination of boron in the sample is made from the observed decline in neutron flux intensity in the passing of slow neutrons through the sample, owing to the nuclear reaction $B^{10}(n,\alpha)Li^{7}$. The measuring technique is described. Lithium determination is based on the nuclear reaction $Li^{6}(n,\alpha)H^{3}$. The effect on analytical results of the moisture content in a sample is assessed, and a formula for determining the content is given. It was concluded that the apparatus possesses high metric and operational parameters, is compact and portable, and safeguards servicing personnel from ionizing radiation. M.G.J.

N67-21306# Israel Program for Scientific Translations, Ltd., Jerusalem.

X-RAY-RADIOMETRIC METHOD AND EQUIPMENT FOR RAPID ANALYSIS OF THE CHEMICAL COMPOSITION OF SUBSTANCES

A. L. Yakubovich and V. Yu. Zaleskii *In its* The Uses of Radioactive Isotopes and Nucl. Radiation in the U.S.S.R., Vol. 4 1966 p 207–218 (See N67-21281 10-13) CFSTI: HC $3.00/MF $0.65

An analytical method was developed based on the excitation of the electrons of the inner shells. Although this X-ray radiometric method is similar to the fluorimetric technique, essential differences are pointed out. These include: (1) Radioactive isotopes are used to excite the characteristic X-ray radiation of the investigated atoms. (2) A scintillation spectrometer is used to isolate and measure the characteristic radiation, usually in combination with Ross differential filters or an ionization spectrometer with a proportional counter. Three factors are cited for determining sensitivity threshold: density of the exciting flux of photons or electrons in the vicinity of the sample; the recorded fraction of photons of the analytical line; and the background level. Requirements for the exciting radiation sources are specified. It is pointed out that the choice of analytical technique depends on such factors as the atomic number of the element, the composition of the sample, and the available amount of the sample. Data on thin layer, saturated layer, and two layer measurements are given. M.G.J.

N67-21307# Israel Program for Scientific Translations, Ltd., Jerusalem.

NUCLEAR RADIATION IN X-RAY SPECTROSCOPY

K. I. Narbutt, R. L. Barinskii, and I. S. Smirnova *In its* The Uses of Radioactive Isotopes and Nucl. Radiation in the U.S.S.R., Vol. 4 1966 p 219–221 (See N67-21281 10-13) CFSTI: HC $3.00/MF $0.65

An X-ray fluorescence spectrometer with a nuclear source of primary radiation is discussed. The characteristic X-ray K-radiation of elements from As^{33} to U^{92} is excited by gamma and X-ray radiation of a Tm^{170} source. The analytical tasks for which the instrument is suited are listed, and brief data are presented on its application to the identification of minerals. Several advantages of the equipment are cited: (1) The substitution of a radioactive source for the X-ray tube eliminates complex and expensive electrical components, and the stabilization of the working regime of the X-ray tube. (2) Power consumption is drastically reduced, being limited only to the electronic counting apparatus. (3) Running water is not needed to cool the X-ray tube. M.G.J.

N67-21314# Israel Program for Scientific Translations, Ltd., Jerusalem.

RADIOACTIVE INDICATORS IN STUDIES OF THE CONCENTRATION OF MICROCOMPONENTS IN NATURAL WATERS

I. Yu. Sokolov, V. A. Polyakov, and V. V. Lushnikov *In its* The Uses of Radioactive Isotopes and Nucl. Radiation in the U.S.S.R., Vol. 4 1966 p 283–287 (See N67-21281 10-13) CFSTI: HC $3.00/MF $0.65

Radioactive indicators were used to investigate the group concentration of zinc, tin, niobium, germanium, and gallium microcomponents in natural waters. The methods used involved the precipitation of microcomponents with aluminum hydroxide in the presence of sodium sulfide; the precipitation of a group of elements with cadmium sulfide in the presence of a ferric salt; and the possibility of concentrating microcomponents on activated carbon. Characteristics of the radioisotopes used as indicators are tabulated. The methods used to measure the activities of precipitates are listed, and experimental results are assessed. M.G.J.

N67-21316# Israel Program for Scientific Translations, Ltd., Jerusalem.

RAPID DETERMINATION OF THE LEAD CONTENT PERCENTAGE IN ORES AND CONCENTRATES

A. A. Abdullaev, E. M. Lobanov, A. P. Novikov, and A. A. Khaidarov *In its* The Uses of Radioactive Isotopes and Nucl. Radiation in the U.S.S.R., Vol. 4 1966 p 298–299 (See N67-21281 10-13) CFSTI: HC $3.00/MF $0.65

Details are given on a method of recording the scattered beta radiation, in which samples with known lead content were irradiated with a Tl^{204} beta source. Since the density of elements constituting the containing rocks is 1/3 to 1/4 the density of lead, variations in the intensity of scattered beta radiation are mainly determined by the variations in the lead content percentage. The results are used to plot a standard graph for the relationship of

scattered beta radiation and lead content percentage. A block diagram of the apparatus is included. The sample and the standard are simultaneously irradiated by the beta source, and the scattering is recorded separately by two end-counters. As a compensation system is used, no current appears when the lead content in each is the same. However, if the content is different, current flows through the apparatus and the pointer shows the lead content percentage in the sample. It was found that discrepancy between the results of chemical and radiometric analyses of samples with 15% to 60% lead does not exceed 5%. M.G.J.

N67-21317# Israel Program for Scientific Translations, Ltd., Jerusalem.

ALPHA RADIATION IN AUTOMATED CONTROL OF THE ELEMENTARY COMPOSITION OF CERTAIN ORE CONCENTRATES

I. N. Plaksin, V. N. Smirnov, and L. P. Starchik *In its* The Uses of Radioactive Isotopes and Nucl. Radiation in the U.S.S.R., Vol. 4 1966 p 300–307 (See N67-21281 10-13) CFSTI: HC $3.00/MF $0.65

Two analytical methods with Po^{210} alpha radiation are described: analysis from neturon radiation emitted by the reaction (α,n) of the capture of nuclear particles, and activation analysis. The nuclear reaction (α,n) was applied to the quantitative determination of beryllium, boron, and fluorine in concentration products. Artificial radioactivity induced by alpha particles was also applied to the analysis of powder samples in controlling the processing of ores containing aluminum and boron. The automatic control of the contents of beryllium, boron, and fluorine, based on the nuclear reaction, is implemented by a conveyor belt device which continuously feeds the concentrates into the zone of alpha radiation. The operational principles are described. M.G.J.

N67-21339# White Sands Missile Range, N. Mex. Atmospheric Sciences Lab.

A REAGENT FOR THE SIMULTANEOUS MICROSCOPIC DETERMINATION OF QUARTZ AND HALIDES

Henry Nusbaum Oct. 1966 19 p ref

(ECOM-5085; AD-644817) CFSTI: HC $3.00/MF $0.65

A reagent was discovered whereby the techniques of dispersion staining microscopy and spot testing may be combined to distinguish halite from quartz in samples of atmospheric dust. The preparation of the reagent and its application are discussed. Author (TAB)

N67-21372# Washington Univ., Seattle.

SOME NEW REACTIONS OF TRIFLUOROMETHANESULFENYL (CF_3S) COMPOUNDS

B. W. Tattershall and George H. Cady 14 Oct. 1966 11 p refs

(Contract Nonr-477(16); ARPA Order 26-60)

(TR-59; AD-641220) CFSTI: HC $3.00/MF $0.65

Various reactions were allowed to occur which offered possibilities of producing the substance CF3SCOC1. A substance obtained in low yield by the reaction of CF3SC1 with CO had infrared and mass spectra of the type expected for CF3SCOC1. The substance was not definitely identified. Various combinations shown below in equations were tried. The principal products are shown at the right. Those in parentheses were not definitely identified but there is good reason to feel that they were formed. 2CF3SC1 + CO + photon = CF3SSCF3 + COC12; CF3SSCF3 + (COC1)2 + photon yields CF3SC1 + 2CO; 3(CF3S)2Hg + COC12 yields CF3SHgC1 + (CF3S)2CS; CF3SH + COC12 at 100C yields No reaction. Author (TAB)

N67-21373# Group for the Advancement of Spectroscopic Methods, Paris (France).

ENERGY LEVELS OF POLYATOMIC MOLECULES, PART I Final Report, 1 Feb. 1960–31 Jun. 1966

G. Amat 15 Mar. 1966 84 p refs

(Contract AF 61(052)-369)

(AFCRL-66-430, Pt. 1; AD-642830) CFSTI: HC $3.00/MF $0.65

The rotation-vibration energies of polyatomic molecules were computed to the fourth order of approximation. These energies are used to obtain the frequencies of lines in rotation and rotation-vibration spectra. Such very accurate calculations are necessary in order to explain many effects observed in very high resolution spectra. The following topics are emphasized: the quartic anharmonic potential function; the rotation spectrum of axially symmetric molecules in an excited vibrational state; the rotation-vibration spectra of spherical top molecules; anomalous rotational structure of level 03(1)1 in the rotation-vibration spectrum of C(13) O2(16); rotational structure of the fundamental NU6 of methyl cyanide; a general discussion of Fermi resonance in CO2 with a new assignment of vibrational levels. Author (TAB)

N67-21379# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

LIGHT SENSITIVITY OF POLYVINYLCINNAMATE AND ITS NITRODERIVATIVES

A. P. Belyakova, Yu. S. Bokov, V. P. Lavrishchev, P. G. Konovalov, and D. N. Vaskevich 14 Jul. 1966 9 p refs Transl. into ENGLISH from Vysokomolekul. Soedin. (Moscow), v. 7, no. 9, 1965 p 1637–1640

(FTD-HT-66-145; TT-67-60300; AD-644044) CFSTI: HC $3.00/MF $0.65

Polyvinylcinnamate and its o -, m - and p - nitroderivatives were synthesized and investigated with respect to their behavior towards ultraviolet light. The solubility, thermomechanical properties and infrared and ultraviolet spectra of the compounds were studied. They are capable of photochemical structuration on irradiation with ultraviolet light, forming the following series with respect to photosensitivity: polyvinylcinnamate <polyvinyl-o-NO2-cinnamate <polyvinyl-m-NO2-cinnamate<polyvinyl-p-NO2-cinnamate. Author (TAB)

N67-21422# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

ON THE CHARACTERISTICS OF INDUCED COMBINED DISPERSION IN BENZENE

V. L. Broude, L. P. Vil'chyns'ka et al 27 Sep. 1966 6 p refs Transl. into ENGLISH from Ukr. Fiz. Zh. (Kiev), v. 9, no. 9, 1964 p 1031–1032

(FTD-HT-66-174; AD-644009) CFSTI: HC $3.00/MF $0.65

An induction combination dispersion was obtained in purified benzene, which was contained in the resonator of a ruby laser, and the characteristics of its origin were investigated. TAB

N67-21512# Atomic Weapons Research Establishment, Aldermaston (England).

OXIDATION OF RARE EARTH METALS. PART 2: PRASEODYMIUM

P. M. S. Jones and W. Edmondson Oct. 1966 12 p refs

(AWRE-O-72/66) HMSO: 2s 6d

The oxidation of praseodymium foil in pure oxygen is found to have a rate directly proportional to the oxygen pressure after the initial parabolic reaction stage. The data are interpreted as showing that the oxide protective layer reaches a limiting thickness which is greater at higher temperatures; thereafter the oxide barrier becomes porous at the outer layers at a rate comparable to the rate of fresh oxide production. The activation energy for the reaction is 27 kcal/mole which is comparable to the value for the diffusion of oxygen through the oxide in the parabolic stage of the reaction. Author (NSA)

N67-21524# Sandia Corp., Albuquerque, N. Mex.
SAFETY IN A CHEMISTRY LABORATORY
R. G. Elsbrock Oct. 1966 36 p refs Presented at Symp. on Chem. Safety, Albuquerque, N. Mex.
(Contract AT(29-1)-789)
(SC-R-66-959; CONF-661029-1) CFSTI: HC $3.00/MF $0.65

Safe practices in handling hazardous chemicals are discussed. Topics covered include: rules for laboratory safety, chemical hazards, housekeeping, safety equipment, and laboratory manipulations. NSA

N67-21535# Illinois Univ., Urbana.
NO TITLE Research and Development Report, 1 Oct. 1965–30 Sep. 1966
Peter E. Yankwich 30 Sep. 1966 165 p refs
(Contract AT(11-1)-1142)
(COO-1142-71) CFSTI: HC $3.00/MF $0.65

Separate articles are included for studies on: isotope effects in gas-phase decomposition of deutero-oxalic acid; isotope effects in gas-phase decomposition of ordinary oxalic acid; anomalous temperature dependence of kinetic isotope effects; kinetics and deuterium isotope effects in the reaction of nitrogen dioxide and formic acid; electron gun performance using a modified appearance potential technique; and direct calculations of kinetic isotope effects, including variations of the reaction coordinate. Brief summaries are given of developments in studies on: carbon isotope effects in metal-ion oxidations of formic acid; kinetics and carbon isotope effects in the isomerization of cyclopropane; carbon isotope effects in the decompositions of malonic acid and hydrogen malonate ion; carbon isotope and stoichiometric effects in the pyrolysis of manganous oxalate, including variations with degree of decomposition; mass spectrometry of gas-phase decomposition of oxalic acid; and flash photolysis of formic acid vapor. NSA

N67-21544# Iowa State Univ. of Science and Technology, Ames.
KINETICS OF THE OXIDATION OF THULIUM BY OXYGEN AND WATER VAPOR
John Thomas Rider (M.S. Thesis) Aug. 1966 86 p refs
(Contract W-7405-ENG-82)
(IS-T-121) CFSTI: HC $3.00/MF $0.65

An examination was made of the kinetics of the reaction of thulium with oxygen, water vapor, and mixtures of the two in the temperature range 650 to 850°C at varying pressures. The reaction was studied gravimetrically as a function of time, temperature, and pressure. In general the data was found to obey a parabolic rate law, although there was some indication of a linear law at lower temperatures and a cubic law at the highest temperatures. The water vapor reaction was found to liberate a gas, probably hydrogen. By using the Arrhenius equation the activation energies were calculated as 28.0 kcal/mole for reaction with oxygen at 11 to 12 Torr, and 29.0 kcal/mole for reaction with water vapor to 18 to 19 Torr. These values indicated a possible similar mechanism for the two reactions. Data also indicated that inward diffusion of oxygen is the rate controlling factor. The reaction between thulium and mixtures of oxygen and water vapor was found to be more complex. Three different thulium rods were used in the investigation and one of them behaved differently from the other two. Rods I and II gave a highly accelerated rate of reaction with 13 Torr each of oxygen and water vapor between 732 and 768°C, while rod III did not. Photomicrographs of the three rods disclosed that the surfaces of rods I and II were granular at 250 X, while rod III had a relatively homogeneous surface. Rod III was also found to contain more oxygen as an impurity than rods I and II. These facts probably account for the difference in behavior of the three rods. X-ray powder pattern analysis of the coating of a thulium sample that had given an accelerated rate of reaction showed the coating to be Tm_2O_3. Since this pattern was taken sometime after the reaction, the possibility of an unstable thulium hydride in the coating was not ruled out. Author (NSA)

N67-21568# Indiana Univ., Bloomington.
CHEMICAL EQUILIBRIA AT HIGH TEMPERATURES AND THE MECHANISM OF VAPORIZATION OF COMPOUNDS Technical Progress Report, 26 Oct. 1965–29 Oct. 1966
Ralph L. Seifert 29 Oct. 1966 24 p refs
(Contract AT(11-1)-505)
(COO-505-13) CFSTI: HC $3.00/MF $0.65

The thermodynamic quantities, ΔG^0, ΔH^0, ΔS^0, and ΔC_p were measured for AgCl, AgBr, AgI, LiCl, and LiBr from measurements of E^0 over a range of temperature for a reversible galvanic cell in which the cell reaction is the formation of the liquid salt from its constituent elements. The pulsed electrolysis, or electronic commutator, technique that was used produces the free halogen within the cell (more readily ensuring isothermal conditions) and permits monitoring the cell to detect overvoltage, depolarization effects, and proper functioning of the electrodes. Data are presented in graphical and tabular form. NSA

N67-21574# Columbia Univ., New York. Dept. of Electrical Engineering.
BONDING, STABILITY, AND FORMATION OF CUBIC REFRACTORY MONOCARBIDES, MONONITRIDES, AND MONOXIDES
Stephen Paul Denker 21 Nov. 1966 68 p refs
(Contract AT(30-1)-3553)
(CU-3553-5) CFSTI: HC $3.00/MF $0.65

Bonding is discussed in a general way relating all the intrinsic mechanical, chemical, and electrical properties of refractory compounds as observed experimentally to the valence electron concentration. The electronic band structure is described in terms of electronic molecular orbitals (taken as a linear combination of atomic orbitals) involved in cation–cation and cation–anion interactions. The degree of anion and cation interaction can be largely described by the overlap integrals associated with clusters of atomic orbitals. Thus properties which characterize bonding and stability in these compounds can be related to the average valence electron concentration per molecule MX, and thereby directly to the atomic orbitals. It will be demonstrated how maximum stability or optimum binding energy, characterized by properties such as maximum melting point, low-vaporization rate at high temperatures, is achieved by that crystal structure in which nearly all the bonding orbitals are occupied and anti-bonding orbitals vacant. Since in the solid, energy states derived from both types of interactions broaden into bands and overlie each other in energy, maximum stability occurs for a valence electron concentration (VEC) between 8 and 9 valence electrons per molecule. NSA

N67-21579# Michigan State Univ., East Lansing. Dept. of Chemistry.
AN INVESTIGATION OF SOME RARE EARTH BORON, CARBON, NITROGEN, AND RELATED SYSTEMS AT ELEVATED TEMPERATURES Technical Progress Report, 1 Feb. 1966–31 Jan. 1967
Harry A. Eick et al 31 Jan. 1967 64 p refs
(Contract AT(11-1)-716)
(COO-716-023) CFSTI: HC $3.00/MF $0.65

Results are reported for studies on: Ce–O–N system; crystal structure of $La_2(CO_3)_3 \cdot 8\ H_2O$; high temperature phase transition of lanthanol oxide fluorides; thermodynamics of vaporization of SmC_2; problems in congruency characterization of Nd_2O_2Te; preparation and properties of lanthanide oxide carbide phases; synthesis of SmF_2 by reduction of SmF_3 with Sm; effects of the crucible material on the congruency of evaporation of Nd_2O_2S; vaporization of YbC_2; and systems of mixed metal selenides. NSA

N67-21590# Edgerton, Germeshausen and Grier, Inc., Santa Barbara, Calif.
QUENCHING MEASUREMENTS ON ORGANIC SCINTILLATORS

E. Yates, D. Crandall, and J. Kirkbride Nov. 1966 11 p refs Presented at the Symp. on Organic Scintillators, Argonne Natl. Lab., 20–22 Jun. 1966
(Contract AT(29-1)-1183)
(EGG-1183-2111; CONF-660612-6; S-62-TN) CFSTI: HC $3.00/MF $0.65

The effects of oxygen and various organic compounds on quenching of toluene scintillators were studied in order to develop faster liquid organic scintillators having shorter decay times and a minimum of long-tail light output. In the experimental method used, the time distribution of the decay of the scintillation light emission was measured in the nanosecond range. Pulse heights were reduced in all cases; decay times and tail-to-peak ratios, however, increased in some cases but not others. Oxygen was found to be the best quencher of tail emission and piperidine was the best reducer of decay time. NSA

N67-21601# Du Pont de Nemours (E. I.) and Co., Aiken, S. C. Savannah River Lab.
RECOVERY OF ACTINIDES PRODUCED BY A NUCLEAR DETONATION IN VOLCANIC TUFF OR DESERT ALLUVIUM
David G. Karraker and William C. Perkins Dec. 1966 18 p refs
(Contract AT(07-2)-1)
(DP-1055) CFSTI: HC $3.00/MF $0.65

A chemical process was developed to recover transplutonium elements from the debris of a thermonuclear device detonated underground at the Nevada Test Site of the AEC. Author (NSA)

N67-21612# Atomic Weapons Research Establishment, Aldermaston (England).
ANALYTICAL CHEMISTRY MANUALS. A BIBLIOGRAPHY AND INDEX TO THEIR CONTENTS
W. A. Dowden Oct. 1966 114 p refs
(AWRE/LIB/BIB/15) HMSO: 15s

A bibliography of manuals of collected analytical methods, issued as reports, with indexes to the substances determined, materials analyzed, and miscellaneous procedures is presented. The references are in report number order. Author (NSA)

N67-21646# Junta de Energia Nuclear, Madrid (Spain).
DENSITIES-CONCENTRATIONS OF AQUEOUS URANYL NITRATE SOLUTIONS [DENSIDADES-CONCENTRACIONES DE SOLUCIONES ACUOSAS DE NITRATO DE URANILO]
A. Rodrigo Otero, B. Rodriguez Hernandez, and L. Fernandez Rodriguez 1966 19 p refs In SPANISH
(JEN-166-DMA/I-20)

The density–concentration ratios of aqueous uranyl nitrate solutions expressed as U_3O_8 grams/liter, U grams/liter, and hexahydrated uranyl nitrate wt % at different temperatures, were established. Experimental values are graphically correlated and compared with some published data. Author (NSA)

N67-21647# Junta de Energia Nuclear, Madrid (Spain).
SPECTROCHEMICAL ANALYSIS OF ALUMINUM AND ITS ALLOYS, AND S.A.P. [ANALISIS ESPECTROQUIMICO DE ALUMINIO Y SUS ALEACIONES Y DE S.A.P.]
M. Roca 1966 15 p refs In SPANISH
(JEN-165-DQ/I-58)

Three different techniques were employed for the Spectrochemical analysis of aluminum, aluminum alloys, and SAP. In the point to plane method with condensed spark and direct reading spectrometry, from the study on instantaneous spectral-line intensities, a long preintegration time was established. In the powdered-samples technique with a dc arc and direct reading spectrometry samples were transformed into Al_2O_3 and mixed with graphite powder (1:1). A complete study on the behavior of the different elements in aluminum oxide, aluminum sulfate and their mixtures with graphite, was carried out. A carrier-distillation method was used for very low concentrations of boron and cadmium in SAP. Author (NSA)

N67-21649# General Electric Co., Schenectady, N. Y. Knolls Atomic Power Lab.
EXPLOSION AND DETONATION LIMITS FOR AN OXYGEN–HYDROGEN–WATER-VAPOR SYSTEM
R. L. Mathews Jun. 1966 54 p refs
(Contract W-31-109-ENG-52)
(KAPL-M-6564) CFSTI: HC $3.00/MF $0.65

A conservative set of limits for the allowable oxygen concentration in an oxygen–hydrogen–water vapor system as a function of various temperatures and water vapor conditions is defined and evaluated. The oxygen limits are expressed for both superheated vapor conditions and for isothermal temperature conditions. The oxygen limits are based on the assumption that the steam–gas mixture will not be combustible as long as the energy release from the complete combustion of the oxygen is not sufficient to raise the temperature of the mixture to 1000°F in a constant pressure process. Calculations are presented for detonation limits according to the Belles detonation theory. Since the calculated temperatures for cases with appreciable water vapor are exceedingly high, it appears that some of the slower radical reactions which are neglected in the Belles theory may become important. In order to provide a very conservative limit for the oxygen concentration which could cause detonation, the Belles theory is extended to include predictions based on the reactions proposed by Lewis and von Elbe for the third autoignition limit. Author (NSA)

N67-21652# Junta de Energia Nuclear, Madrid (Spain).
DIRECT-READING SPECTROCHEMICAL ANALYSIS OF SODIUM URANATE [ANALISIS ESPECTROQUIMICO DE LECTURA DIRECTA DE URANATO SODICO]
M. Roca and C. Capdevila 1966 17 p refs In SPANISH
(JEN-164-DQ/I-57)

Application of the quantometer to the analysis of sodium uranate is described. To determine boron, cadmium, phosphorus, and molybdenum contents, the samples were mixed with graphite powder (1:30) and excited in a 10-amp dc arc with 4×4.5 mm cup graphite rods, using silver as the internal standard. A not-so-deep cup and a dilution factor of 90 were more suitable for calcium, copper, iron, silicon, and vanadium determination; cobalt and chromium were the internal standards. Author (NSA)

N67-21653# Junta de Energia Nuclear, Madrid (Spain).
GENERAL METHOD OF QUANTITATIVE SPECTROGRAPHIC ANALYSIS [ESTUDIO DE UN METODO GENERAL DE ANALISIS ESPECTROGRAFICO CUANTITATIVO]
C. Capdevila and M. Roca 1966 10 p refs In SPANISH
(JEN-163-DQ/I-56)

A spectrographic method was developed to determine 23 elements in a wide range of concentrations; the method can be applied to metallic or refractory samples. Previous melting with lithium tetraborate and germanium oxide was done in order to avoid the influence of matrix composition and crystalline structure. Germanium oxide was employed as internal standard. The resulting beads were mixed with graphite powder (1:1) and excited in a 10-amp dc arc. The possibility of avoiding previous melting was studied, but this caused a lower precision. Author (NSA)

N67-21657# Los Alamos Scientific Lab., N. Mex.
A COMPARISON OF THREE METHODS OF OXYGEN CONCENTRATION MEASUREMENT IN SODIUM
Charles C. Mc Pheeters and James M. Williams [1966] 35 p refs Presented at the Intern. Atomic Energy Agency Symp. on Alkali Metal Coolants, Corrosion Studies, and System Operating Experience, Vienna
(Contract W-7405-ENG-36)
(LA-DC-7743; CONF-661110-5; SM-85/29) CFSTI: HC $3.00/MF $0.65

Two electrochemical oxygen meters, an ac resistivity meter, and a vacuum distillation sodium sampler were tested to determine their sensitivities and responses to oxygen concentration changes in sodium. These tests were conducted on an isothermal, forced convection sodium loop of large volume; a bypass cold trap provided for oxygen concentration control. A vacuum distillation analytical technique was used as the primary standard for measurement of the oxygen concentration. Experimentally determined calibration curves for the electrochemical cells agree closely with the theoretical predictions in the slope, but the emf values were approximately 85% of theoretical. The ac resistivity meter was calibrated by comparing per cent resistivity with vacuum distillation and analyses. The meter was found to have an oxygen concentration dependence of 0.0070% resistivity change per ppM weight change in oxygen concentration, compared to the predicted value of 0.01%. Later in the experiment this dependence was found to be 0.0139% resistivity change per ppM oxygen. This shift is attributed to the effect of other impurities added to the system. In order to determine the response times of the oxygen meters and the resistivity meter, a step change was made in the cold trap temperature. Within the error of the measurements, all instruments responded in good agreement with the vacuum distillation analyses. The total time elapsed from the beginning of the concentration transient to system equilibrium was 130±10 hours. The efficiency for oxygen addition to the system from the cold trap was found to be 20%. NSA

N67-21660# California Univ., Livermore. Lawrence Radiation Lab.

DETERMINATION OF IMPURITIES IN MOLYBDENUM BY EMISSION SPECTROSCOPY

E. E. Albin and W. F. Morris 5 Oct. 1966 12 p refs *Its* Gen. Chem. Tech. Note No. 245
(Contract W-7405-ENG-48)
(UCID-15039) CFSTI: HC$3.00/MF$0.65

The principle of establishing excitation conditions that favor the impurity spectra while suppressing the matrix spectrum was applied to the analysis of Mo with some modification of electrode configuration and arc conditions. The formation of Mo_2C in the electrode crater was optimized, thus reducing considerably the overshadowing of impurity lines by Mo. NSA

N67-21691# Soreq Research Establishment, Israel Atomic Energy Commission, Yavneh.

DETERMINATION OF PERMANENT GASES BY GAS CHROMATOGRAPHY Preliminary Report

M. Wiernik May 1966 19 p refs
(IA-1066) CFSTI: HC$3.00/MF$0.65

Several methods for the determination of permanent gases are discussed. The two columns–two half detectors method is described and data on retention values and calibration linearity are given. The gases determined included mixtures of H_2, O_2, Ar, CH_4, CO_2, CO, N_2, and SH_2. NSA

N67-21710# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

INTERMOLECULAR REACTION AND DISPLACEMENTS OF OSCILLATION FREQUENCIES OF MOLECULES IN COMBINED DIFFUSION SPECTRAS

I. L. Babych and I. I. Kondilenko 18 Aug. 1966 6 p refs Transl. into ENGLISH from Ukr. Fiz. Zh. (Kiev), v. 8, no. 11, 1963 p 1270–1271
(FTD-HT-66-171; TT-67-60298; AD-644010) CFSTI: HC $3.00/MF$0.65

A report is given of a systematic investigation of the effects of concentration on the frequency displacement of the combined diffusion spectra of carbon tetrachloride in toluene and of nitrobenzene in methanol. TAB

N67-21718# California Univ., Berkeley. Thermal Systems Div.

OXIDES OF NITROGEN IN ENGINE EXHAUST WITH AMMONIA FUEL

R. Sutton and E. S. Starkman Jun. 1966 27 p refs
(Contract DA-04-200-AMC-791(X))
(TS-66-4; TR-7; AD-640444) CFSTI: HC$3.00/MF$0.65

At maximum output, more oxides of nitrogen are produced by combustion of ammonia than with hydrocarbon fuels. This is partly a result of peak power occurring at low mixtures with ammonia. Disproportionate quantities of nitrogen oxides which are encountered with ammonia at lean mixture ratios indicate a probable result of the direct production of NO in the ammonia pyrolysis scheme. Author (TAB)

N67-21745# Eidgenossische Technische Hochschule, Zurich (Switzerland).

ON THE ROLL OF THE π COMPLEXES AND ϕ COMPLEXES IN THE ELECTROPHILIC AROMATIC SUBSTITUTION [ZUR ROLLE DER π- UND ϕ-KOMPLEXE IN DER ELEKTROPHILEN AROMATISCHEN SUBSTITUTION]

Paul Kreienbuehl (Ph.D. Thesis) 1966 95 p refs In GERMAN
(Rept.-3807) CFSTI: HC$3.00/MF$0.65

Sulfolan was used as solvent in electrophilic substitutions in aromatic compounds. Nitrations and Friedel–Crafts reactions occur extremely fast in this solvent. The cause of this increased reaction speed was investigated by comparing the reaction times of an azo compound in water and in Sulfolan. No advantages were noted. The nitration of pentamethylbenzol was investigated in greater detail. This reaction was kinetically not of the first order in each reaction component, but it was of the first order for the less concentrated component, and it was also kinetically independent from the concentration of the extract in the remainder. Nuclear magnetic resonance spectroscopy and optical measurements were used to determine the structure of primary adducts. The results indicate that the adducts are strongly localized π complexes. It is concluded that this reaction does not follow previously established patterns. Transl. by K.W.

N67-21759# Eidgenossische Technische Hochschule, Zurich (Switzerland).

CONTRIBUTION ON THE CHEMISTRY OF TRIVALENT ANTIMONY [BEITRAG ZUR CHEMIE DES DREIWERTIGEN ANTIMONS]

Jorge Serrallach (Ph.D. Thesis) 1966 96 p refs In GERMAN
(Rept.-3713) CFSTI: HC$3.00/MF$0.65

Starting with antimontrimethylate, a number of alkoxo and aryloxo complexes of Sb(III) were prepared from nonaqueous methanol, followed by the replacement of the methoxylate in the $Sb(OCH_3)_3$ by mercaptan, again excluding water. The addition reaction of alcoholate, phenolate, and mercaptan with Sb(III) was determined in absolute methanol by quantitative balance measurements. Results indicate that the coordinate number of Sb(III) takes on the values 3, 4, and 5 compared with oxygen. The tendency of an addition of a 4th and 5th ligand atom is small but increases if a chelate ring can form. The results agree in general with the known chemistry of antimony. Transl. by K.W.

N67-21778# Eidgenossische Technische Hochschule, Zurich (Switzerland).

CONTRIBUTION TO THE UNDERSTANDING OF POLYVINYL ETHER [BEITRAG ZUR KENNTNIS DER POLYVINYLAETHER]

Guenter Kaupp (Ph.D. Thesis) 1966 82 p refs In GERMAN
(Rept.-3793) CFSTI: HC$3.00/MF$0.65

The color phenomena which occur during the mixing of aqueous solutions of polyvinylmethylether with mineral acids were investigated. It was proven that industrial polyvinylmethylether contains OH groups in the side chain in addition to the ether groups. It was furthermore noted that the mineral acids cause the

separation of ether groups and the formation of polyenes; the structure of the polyenes was determined. Changes in the color and the changes in the structure of the polyvinylether caused by the acids are attributed to the formation of electron donor–acceptor complexes. The same reaction mechanism was also observed in the effects of Storch–Morawski reagent and trifluor acetic acid. Transl. by K.W.

N67-21784# European Co. for the Chemical Processing of Irradiated Fuels, Mol (Belgium).

STUDY OF URANIUM(IV) NITRATE AS REDUCING AGENT FOR PLUTONIUM. IIA: STABILITY OF URANIUM(IV) (IV) IN SOLUTION

E. Lopex-Menchero, L. Salomon, and G. Bardone Mar. 1966 69 p refs

(NP-16328; ETR-181) CFSTI: HC $3.00/MF $0.65

The stability of uranium(IV) nitrate was studied in an aqueous nitric acid phase, in an organic phase (30% TBP in SST), and in an emulsion of an aqueous phase with an organic phase. The study was related to the data for the use of uranium(IV) as reducing agent for plutonium(IV) in a U–Pu partition cycle of the Eurochemic separation flowsheet. It was found that aqueous nitric acid solutions of uranium(IV), by themselves very unstable, can be made very stable by the addition of hydrazine in a suitable quantity. On the other hand, in the organic phase the oxidation that takes place and that is 100 to 1000 times faster than that in the aqueous phase stabilized with hydrazine, remains just as fast (and is often faster) when this organic phase is put into contact with an aqueous phase containing hydrazine. An important result was the stabilization of uranium(IV) nitrate in the organic phase or in an emulsion, when an inert atmosphere was used. Absence of light was very favorable to the stability. Author (NSA)

N67-21805# Commissariat a l'Energie Atomique, Fontenay-aux-Roses (France). Centre d'Etude Nucleaires.

FIXATION OF METALLIC ACETATES ON AN ANION-EXCHANGE RESIN [FIXATION D'ACETATES METALLIQUES DANS UNE RESINE ECHANGEUSE D'ANIONS]

Michele Brigaudeau-Vaissiere Jun. 1966 64 p refs In FRENCH

(CEA-R-2994)

Theoretical principles governing the fixation of anionic complexes of metallic elements on an anion exchange resin are reviewed, and the particular case of uranyl acetate considered. By plotting the partition curves, the exchange constants in the resin could be calculated. By studying the changes in the logarithm of the limiting partition coefficient as a function of the logarithm of the free acetate ion concentration, it was possible to calculate the dissociation constants for the complexes in solution. The fixation of a large number of metallic acetates was studied. All the tests were negative except in the case of mercury. The possibility of separating uranium from a certain number of elements was considered. Some of these separations are possible even in the presence of interfering anions such as chlorides, which have a greater affinity for the resin than have the acetate ions. In the case of water–ethanol and water–isopropanol mixtures, the conditions under which copper acetate and mercury acetate may be fixed were improved. The dissociation constant was calculated for the $CuAc_3^-$ complex in the mixtures water + 40% (by weight) isopropanol and water + 50% ((by weight) isopropanol. Author (NSA)

N67-21806# Commissariat a l'Energie Atomique, Sacaly (France). Centre d'Etudes Nucleaires.

INSTALLATION FOR ANALYTIC CHEMISTRY UNDER IRRADIATION [INSTALLATION DE CHEMIE ANALYTIQUE SOUS RAYONNEMENT]

Jean Fradin, Pierre Azoeuf, and Andre Guillon May 1966 119 p In FRENCH

(CEA-R-2887)

An installation was set up for carrying out manipulations and chemical analyses on radioactive products. It is completely remote-controlled and is of linear shape, 15-m long; it is made up of three zones: an active zone containing the apparatus, a rear zone giving access to the active zone, and a forward zone independent of the two others and completely protected. It is from this zone that the remote-control of the apparatus is effected. The whole assembly was designed so that each apparatus corresponding to an analytical technique is set up in a sealed enclosure. The sealed enclosures are interconnected by a conveyor. After three years operation, a critical review is made of the installation. Author (NSA)

N67-21813# Thiokol Chemical Corp., Danville, N. J. Reaction Motors Div.

SYNTHESIS AND EVALUATION OF COMPLEX POLYAMMONIUM HYDRIDES Report, Dec. 28, 1965–Jun. 30, 1966

Harry F. Smith 30 Jun. 1966 41 p refs

(Contract W-7405-ENG-48)

(RMD-5084-F; UCRL-13222) CFSTI: HC $3.00/MF $0.65

New, more efficient, and more economical processes have been developed for the synthesis of two quaternary ammonium halides which are precursors of borohydride salts of interest as neutron moderators. These processes involve the quaternization of ditertiary amines, 1,4-dimenthylpiperazine and 1,4-diazabicyclo [2.2.2]octane, with methyl chloride under pressure. The processes were scaled up to produce about one pound of 1,1,4,4-tetramethylpiperazinium dichloride (TMPDC) and 0.7 pound of 1,4-dimethyl-1,4-diaziniabicyclo [2.2.2] octane dichloride (DMPOC) per batch, in yields up to 98–99%. A six-pound supply of each of these chlorides was produced and delivered, for further exploration of the metathetical reactions by which the borohydrides are prepared. Alternate routes to these quaternary ammonium ions were discovered. Analogs of TMPDC and DDBOC were prepared by the reaction of ethylene bromide with tetramethylethylenediamine and 1,4-dimethylpiperazine, respectively. This process could presumably be adapted to utilize ethylene chloride if desired. Three potential synthesis routes leading to poly(ethylenedimethylammonium halides) were explored in detail. NSA

N67-21814# Oesterreichische Studiengesellschaft fuer Atomenergie G.m.b.H., Seiberdorf (Austria).

PERFLUOROALKANES AS FAST-NEUTRON INSENSITIVE CHEMICAL DOSIMETERS

E. Proksch and E. Slais [1966] 16 p refs Presented at the Symp. on Solid-State and Chem. Radiation Dosimetry, Vienna, 3–7 Oct. 1966

(SGAE-CH-37/1966; CONF-661005-24)

Perfluoroalkanes are especially suitable for use as gamma dosimeters in mixed radiation fields. Their sensitivity to fast and thermal neutrons is small and the yield of the gaseous products formed should be a convenient measure of absorbed dose. Using a gas-chromatographic technique, the amount of fluorocarbon necessary for a single measurement can be reduced to about 100 milligrams. As examples, the "perfluorokerosene" mixtures as well as pure perfluoro-n-hexane were investigated. Both of them proved to be suitable, especially the perfluoro-n-hexane. Without degassing, it may be used with gas yields constant to ±3% in the dose range from 3 to 40 MRAD. A variation in dose-rate from about 50 kRAD/hr to 100 MRAD/hr had but a slight influence on the yields. For measurement of lower doses complete degassing and further purification of the material used was necessary. Author (NSA)

N67-21820# Westinghouse Electric Corp., Pittsburgh, Pa. Research Labs.

HYDROGEN REACTIONS WITH ALLOYS OF ZIRCONIUM AND THE METALS VANADIUM, CHROMIUM, IRON, COBALT, NICKEL, COPPER, MOLYBDENUM, AND NIOBIUM Annual Report, Jun. 1, 1965–Mar. 1, 1966

E. A. Gulbransen, A. R. Pebler, and K. F. Andrew 21 Feb. 1966 32 p refs
(Contract AT(30-1)-3203)
(WERL-3203-5) CFSTI: HC$3.00/MF$0.65

A program is being conducted to study the nature and mechanism of the reactions of Zr alloys with water vapor at 300 to 600°C. Summaries are presented of work done in the following areas: rebuilding of the hydrogen absorption apparatus, thermochemical and structural aspects of the reactions of hydrogen with alloys and intermetallic compounds of Zr, hydrogen analysis of oxidized Zr and its alloys, and oxidation studies at 500°C on Zr, Zircaloy II, and Zircaloy IV. A paper on equilibrium studies on the Zircaloy IV–hydrogen system between 350 and 700°C is also included. NSA

N67-21827# United Kingdom Atomic Energy Authority, Windscale (England). Technical Dept.
ANALYTICAL METHOD FOR THE DETERMINATION OF IRON IN HIGH-PURITY PLUTONIUM
G. A. Bell, P. R. Stanwix, and D. G. Boase 1966 11 p refs
(PG-709/W/) HMSO: 2s 6d

A method is described for the determination of Fe in Pu metal. Iron(II)–tris-bathophenanthroline complex is formed in the presence of EDTA which suppresses the interference and hydrolysis of Pu. Solvent extraction of the colored Fe complex into chloroform adds specificity to the method, and subsequent absorptiometric measurement allows the determination of Fe to levels of 1 to 2 ppM in Pu metal. A precision (3σ) of ±10% can be achieved at the 10 ppM level. Author (NSA)

N67-21840# Coating and Chemical Lab., Aberdeen Proving Ground, Md.
VALID AND NON-VALID DIMENSIONAL ANALYSES OF THE DETERGENCY PROCESS Progress Report
A. Mankowich Oct. 1966 44 p refs
(CCL-211; AD-642834) CFSTI: HC$3.00/MF$0.65

Recent work at this laboratory on the application of dimensional analysis to the detergency process using commercial hard surfactants was further validated by data on twenty soil-surfactant systems in which the surfactants were commercial biodegradable nonionics. The previous validation was made more meaningful by re-calculations with CMC and surface tension values determined in this laboratory replacing the previously-used literature values of homogeneous materials. Dimensional analyses with detergency assigned the dimensions of work, M(L sq. /T sq.), and of force, ML/(T sq.), as substitutes for the postulated ML(M=mass, L=length, T=time) could not be validated. The relevance of the variables comprising the valid dimensional analysis was enhanced by the non-validation of several dimensional analyses based on other groups of apparently critical process parameters. Author (TAB)

N67-21852# Westinghouse Electric Co., Pittsburgh, Pa. Research and Development Center.
ADVANCED CRYSTAL GROWING TECHNIQUES Final Report, 1 Nov. 1965–31 Oct. 1966
R. G. Seidensticker, A. I. Bennett, and D. R. Hamilton 23 Jan. 1967 50 p refs
(Contract AF 19(628)-5722)
(Rept.-67-9F6-MIOPT-R1; AFCRL-66-832; AD-646271) CFSTI: HC$3.00/MF$0.65

The report describes a novel technique for floating zone crystal growth in which a resistively heated filament is immersed directly in the molten zone. Two furnaces employing this technique are described in some detail. Various considerations for the design of the filaments and for the preparation of feed rods are also discussed. Finally, experiments in the growth of apatite, spodumene, $LiNbO_3$, sapphire, KTN and KCl are discussed. Author (TAB)

07 COMMUNICATIONS

Includes communications equipment and techniques; noise; radio and communications blackout; modulation telemetry; tracking radar and optical observation; and wave propagation. For basic research see: 23 Physics, General; and 21 Navigation.

N67-20472# Illinois Univ., Urbana. Biological Computer Lab.
A METHOD OF DECODING SPEECH Scientific Interim Report
Jeno Gazdag Jun. 1966 138 p refs
(Contracts AF 33(657)-10659; AF 33(615)-2573; AF 33(615)-3890; Grants AF-AFOSR-7-66; PHS-GM-10718)
(TR-9; AD-641132) CFSTI: HC$3.00/MF$0.65

A method is presented for decoding speech that uses machine events as the basic linguistic units, in contrast with phonemes and other units employed in other studies. The machine events are represented as multidimensional binary vectors. Utterances of words are expressed as sequences of binary vectors. Spoken words are decoded as sub-sequences of machine events. Decoding is independent of time, i.e., it does not depend on the duration of the speech signal. Results are given of small-scale tests of the decoding method. The experimental apparatus consisted of a 12-channel short-time spectrum generator and a machine-event generator that implemented six hyperplanes and a human who assumed the role of a translator in transcribing the six recorded outputs of the machine-event generator into sequences of six-digit binary number representations. Unambiguous decoding was obtained based on recordings of five utterances for each of ten words (the digits, zero to nine) by each of four different speakers. The report discusses theoretical foundations for the decoder, design principles for the short-time spectrum and machine-event generators, and bases for the computation of significant sub-sequences from transitions of the machine events. Appendices describe the method for determining the distribution of the bandpass filters and for computing filter bandwidths. The method suggests a feasible approach to practical speech recognition devices. Author (TAB)

N67-20527# Illinois Univ., Urbana. Coordinated Science Lab.
DECODING PROCEDURES FOR CONVOLUTIONAL CODES
James Ernest Heller Nov. 1966 44 p refs
(Contract DA-28-043-AMC-00073(E))
(R-327; AD-644726) CFSTI: HC$3.00/MF$0.65

A definition of a convolutional code is given in terms of the encoding implementation equipment. A mathematical model consisting of two finite dimensional matrices is then formulated for a convolutional code of redundancy m/b from the encoding procedure. A general decoding procedure for decoding a convolutional code is discussed as an introduction to two specific decoding procedures, algebraic decoding and probabilistic decoding. The necessary and sufficient conditions for algebraic decoding of both independent and burst errors is given and an implementation procedure for algebraic decoding is established. A bound on the complexity of the decoding equipment is also derived for algebraic decoding. Probabilistic decoding and the concept of tree codes is introduced. The implementation procedure for probabilistic decoding is discussed and a bound on the complexity of the necessary decoding procedure is derived. Author (TAB)

N67-20528# Applied Physics Lab., Johns Hopkins Univ., Silver Spring, Md.
THE SEARCH PROBLEM, AN EXPOSITION
C. D. Firestone Jul. 1966 60 p refs
(Contract NOw-62-0604-c)
(TG-844; AD-644694) CFSTI: HC$3.00/MF$0.65

The problem of improving, and if possible optimizing, the scan pattern of a radar that is being used to locate a target

whose position has a known probability distribution has been studied by B. O. Koopman and O. V. Staroverov. This report is a survey and exposition of their results and associated topics. No previous knowledge of mathematics more advanced than elementary calculus is needed. Author (TAB)

N67-20534# Harvard Univ., Cambridge, Mass. Div. of Engineering and Applied Physics.
AN OPTIMUM PULSE AMPLITUDE MODULATION SYSTEM
David A. Shnidman Mar. 1966 78 p refs
(Contract Nonr-1866(16))
(TR-495; AD-640735) CFSTI: HC $3.00/MF $0.65

The optimum (minimum mean square error) linear receiver and transmitter waveform has been jointly determined. The performance of this system is compared with that of the matched filter and the optimum constrained receiver on both a mean square error (MSE) and probability of error (PE) basis. Using the optimum MSE system, performance curves for uncorrelated message sequences are compared with those of correlated sequences. These performance curves are graphs of MSE and PE versus signal to noise (S/N) ratio. Approximating the intersymbol interference distribution with a Gaussian distribution gives PE within a few percent of the exact value. It is found that, for sequences with the same information rate, the correlated sequences have smaller error at low S/N, but at high S/N, the reverse is true. Results are obtained which indicate that, in the absence of accurate information about the message correlation, it is best to design the receiver for an uncorrelated message sequence. The signal energy required to maintain a PE of 0.000001 versus data rate, 1/T, is presented for 2, 3, and 4 level data. Finally, it is shown that a channel with colored noise of spectral density N(f) = a + b numerical value of H(f) to the 2nd power where H(f) is the frequency response of the channel, has the same performance as a channel with white noise with spectral density N(f) = a + b and an appropriately chosen channel frequency response function. Author (TAB)

N67-20580# Raytheon Co., Sudbury, Mass. Space and Information Systems Div.
REPORT ON APPLIED RESEARCH PROGRAM IN ELECTROMAGNETIC ENERGY RAY PATHS, PART I Final Report, 15 Mar. 1965–10 Jul. 1966
Barbara M. Langworthy 23 Nov. 1966 65 p refs
(Contract AF 19(628)-5032)
(FT-66-365, Pt. I; AFCRL-66-748(I); AD-642864) CFSTI: HC $3.00/MF $0.65

Continuing effort has been made on ionogram reduction and data smoothing for use in a Hamiltonian ray tracing program which uses Haselgroves equations. Emphasis in this work has been placed on analog to digital as well as digital to hybrid compatibility. Power losses due to refraction and inverse square law spreading have been computed using a single ray approach. The method is fully described. Ray tracing has been done both with and without magnetic field. Comparison of these results led to the discovery that the magnetic field has a pronounced effect on the ray path even at frequencies much greater than 15 MHz when the path traveled is north-south, or along magnetic field lines. Tabulated results and the underlying factors in the argument are presented. Author (TAB)

N67-20588# Environmental Science Services Administration, Boulder, Colo.
EXPERIMENTAL STUDY OF ATMOSPHERIC ERRORS IN MICROWAVE AZIMUTH MEASUREMENTS
M. C. Thompson, Jr., H. B. Janes, and D. Smith Jul. 1966 54 p refs
(IER-4-ITSA-4; AD-643090) CFSTI: HC $3.00/MF $0.65

An experimental study was made of errors contributed by the atmosphere in azimuth angle measurements made with short-baseline microwave systems. Time variations in the azimuth of a fixed target were found to decrease with increasing radio frequency in the range of 9.4 to 35 GHz. Ground multipath is indicated as the principal source of these variations which are characterized, especially at the lower frequencies, by long-term trends and lack of correlation on adjacent paths. Author (TAB)

N67-20631# Army Electronics Labs., Fort Monmouth, N. J.
NEW CONCEPT FOR REDUCING RANDOM, SHOT, THERMAL, AND IMPULSE NOISE IN AMPLIFIERS
Arthur H. Gottfried Nov. 1966 26 p
(ECOM-2778; AD-644196) CFSTI: HC $3.00/MF $0.65

A new concept is described for reducing random, shot, thermal, and impulse noise in amplifiers. Noise in an inner frequency channel that contains a desired signal is reproduced by a combination of noise in two outer frequency channels adjacent to and equally spaced in frequency from the inner channel. The noise in the desired channel can then be bucked out. Author (TAB)

N67-20640# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
OBSERVATION OF ARTIFICIAL SATELLITES
14 Jul. 1966 9 p Transl. into ENGLISH from Byul. St. Optich. Nablyudeniya Iskusstv. Sputnikov Zemli (USSR), no. 32, 1963 p 33–37
(FTD-HT-66-322; AD-644064) CFSTI: HC $3.00/MF $0.65

Camera HAFA-3c/25, Pankhrome film, DK. Coordinate measurements were made with a UIM-21. Computations on the Ural computer. Time corrections for signal delay in the IP and PRV receiver were carried out. TAB

N67-20666# Army Engineer Geodesy, Intelligence and Mapping Research and Development Agency, Fort Belvoir, Va.
FIXED AND MULTIPLE FREQUENCY ANGLE MEASUREMENTS WITH 35-GHZ MICROWAVES, 14 SEPTEMBER–28 OCTOBER 1965
Mahlon C. Hawker Oct. 1966 78 p refs
(Rept.-33-TR; AD-644582) CFSTI: HC $3.00/MF $0.65

The report covers the results of tests conducted at Fort Belvoir, Virginia, from 14 September through 28 October 1965. These limited tests were performed to determine the feasibility of 35-GHz angle measurements at a fixed frequency instead of multiple frequencies. Analysis of the data collected at Fort Belvoir and from previous tests at San Diego, California, and Boulder, Colorado, indicates that fixed frequency angle measurements are feasible if enough angles are turned, the readings are taken over a period of hours, and all inconsistent results are rejected. In general, the fixed frequency angles are more inconsistent and unreliable than the multiple frequency angles, the variations from the true angle are approximately twice those of the multiple frequency angles, and the time necessary for one fixed frequency measurement is approximately twice that of multiple frequencies. Included is an 8-hour boresight stability run. This run did not show the characteristic increase in angle of arrival excursion during the afternoon hours as was seen during the San Diego and Boulder tests. Author (TAB)

N67-20686# Harvard Univ., Cambridge, Mass. Div. of Engineering and Applied Physics.
AN EXPERIMENTAL INVESTIGATION OF DIELECTRIC COATED ANTENNAS
David Lamensdorf Jun. 1966 51 p refs
(Contract AF 19(628)-2406; Grant NSF GP-2242)
(AFCRL-66-625; SR-13; AD-643862) CFSTI: HC $3.00/MF $0.65

Measurements of the admittance and current distribution of a linear antenna embedded in a low-loss dielectric cylinder have been carried out. The results compare well with a theory by C. Y. Ting. Author (TAB)

N67-20690# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
METHODS OF INCREASING THE ACCURACY OF CODERS BY AUTOMATIC EXCLUSION OF CODING ERRORS
S. M. Persin 23 Sep. 1966 31 p refs Transl. into ENGLISH from Tr. Gl. Geofiz. Observ. (Leningrad) p 14–32
(FTD-TT-65-1585; TT-67-60320; AD-644165) CFSTI: HC $3.00/MF $0.65

The report describes the principles of new methods of increasing the accuracy of analog-digital converters based on automatic compensation of coding errors. Various methods of achieving such compensation with the insertion of a correction in digital or analog form are discussed. It is shown that it is possible to use the proposed methods for increasing the accuracy of primary measurement instruments (PMI) and, in a number of cases (particularly in employing two-stage coding) for increasing the operating speed of the converter. Author (TAB)

N67-20698# Laboratory for Electronics, Inc., Boston, Mass.
ENTROPY CONCEPTS IN COMPLEX SYSTEMS Final Report
Jerome Rothstein 30 Oct. 1966 150 p refs
(Contract AF 49(638)-1450)
(AFOSR-66-2863; AD-643833) CFSTI: HC $3.00/MF $0.65

Intelligence and non-computability; an overview of the conference from an informational-organization-operational viewpoint; the informational-organizational nature of entropy; how well-informed heat engines can refute theories of their behavior; literature references and abstracts of papers by the principal investigator relative to these investigations. Author (TAB)

N67-20707# Applied Physics Lab., Johns Hopkins Univ., Silver Spring, Md.
ELECTROMAGNETIC WAVE PROPAGATION IN CONDUCTING MEDIA An Annotated Bibliography
E. J. Blau and M. J. Lun Sep. 1966 64 p refs
(Contract NOw-62-0604-c)
(TG-230-86; AD-644689) CFSTI: HC $3.00/MF $0.65

This document is an annotated bibliography of the journal and technical report literature (to August 1966) on electromagnetic wave propagation in conducting media, with emphasis on the ocean. References on antenna theory and performance are also included. This work includes 164 references and an author index. Author (TAB)

N67-20721# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
AUTOMATIC SYSTEMS IN RADIOENGINEERING DEVICES
B. Kh. Krivitskiy 15 Sep. 1966 724 p refs Transl. into ENGLISH of the book "Avtomaticheskiye Sistemy Radiotekh Nicheskikh Ustroystv" Moscow, Gosenergoizdat., 1962 p 1–664
(FTD-HT-66-253; TT-67-60199; AD-643593) CFSTI: HC $3.00/MF $0.65

The book examines, on the basis of automatic control theory, the basic automatic systems employed in contemporary radio engineering devices: systems for determining the direction of arrival of radio waves, self-excited oscillator, frequency control systems, systems for determining the time positions of pulses, and gain-control systems. Also described are the most commonly used measuring elements in these systems: amplitude, phase, frequency and time discriminators. Author (TAB)

N67-21052# Aero Geo Astro Corp., Corona, Calif.
VLF IONOSPHERIC SOUNDER PROGRAM Final Report
David J. Shamp, Lawrence E. Christensen, and Andres Farkas 18 Mar. 1966 106 p refs
(Contract Nonr-3163(00))
(AD-640755) CFSTI: HC $3.00/MF $0.65

The VLF pulse sounder is a new basic tool for studying the lower ionosphere. The system is a combination pulse sounder, phase sounder, and polarimeter. A concurrent program of system improvement and experimental study of the ionosphere has been conducted. The results of this program as presented here should be of use in planning various types of communication, navigation, and detection systems which make use of VLF propagation or distribution within the lower ionosphere. Since HF propagation is markedly affected by the lower ionosphere, the program should also ultimately contribute to systems in the HF band. This program was limited to experimental data collection. The gathered data is presented without an assessment of its theoretical value or of the experimental capability employed in its collection. Author (TAB)

N67-21053# Army Electronics Labs., Fort Monmouth, N. J.
WIDE DYNAMIC RANGE VHF PRESELECTOR
Joseph M. Giannotto and Eugene J. Chabak Sep. 1966 38 p refs
(ECOM-2756; AD-640931) CFSTI: HC $3.00/MF $0.65

Simultaneous operation of a transmitter and receiving device in close proximity to each other results in receiver desensitization and distortion due to cross-modulation effects. Utilization of parametric conversion techniques now provides the design engineer with a frequency converter which is considerably more amplitude-linear than conventional devices, with the added features of low noise characteristics and wide dynamic range capability. This report presents a development concerning the design and performance of a tunable parametric preselector operable over the range of 30-70 MHz. Also presented is a discussion of the ramifications of selecting the specific circuitry and parts. Author (TAB)

N67-21167 Joint Publications Research Service, Washington, D. C.
UHF WAVE PROPAGATION IN THE TROPOSPHERE
B. A. Vvedenskiy and M. A. Kolosov 15 Feb. 17 p Transl. into ENGLISH from Priroda (Moscow), no. 12, Dec. 1965 p 16–24
(JPRS-39907; TT-67-30555) CFSTI: HC $3.00

An historical outline of experimental and theoretical work on the propagation and diffraction of radio waves in the troposphere is presented. The primitive equipment and short distance of transmission in the early years, followed by uhf propation, refraction and diffraction are mentioned. The increasing number of uhf broadcasting stations, and the resulting influence in radar, television, and radio electronics are described. It is pointed out that theoretical investigations were directed towards two areas: (1) the incoherent dissipation on the totality of the tropospheric, and (2) the coherent tropospheric layer formations. These are discussed, and the need for a synthesis of both concepts is emphasized. The initial investigations connected with the intensive development of laser engineering are mentioned. N.E.N.

N67-21332# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
COMPRESSED VOICE
V. Demidov 7 Oct. 1966 18 p Transl. into ENGLISH from Znaniye Sila (USSR), no. 11, 1963 p 52–54
(FTD-HT-66-202; AD-644012) CFSTI: HC $3.00/MF $0.65

A discussion is presented on problems of voice communication by telephone, superfluous information present in speech, phonemes and phonoids, the anatomy of sound, the use of band pass filters in voice communication, vocoders, and an electronic collocutor. R.N.A.

N67-21343# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
METHOD OF ELECTRICAL CONTROL OF THE BEAM OF AN ANTENNA ARRAY

V. M. Mamayev, D. D. Korobov, and A. D. Minkin 27 Sep. 1966 6 p Transl. into ENGLISH from Russian Patent No. 171034 (Appl. No. 906299/26-9, 19 Jun. 1964) 2 p
(FTD-HT-66-102; AD-644039) CFSTI: HC $3.00/MF $0.65

The object of the invention is a method of electrical control of the beam of an antenna array accomplished with the aid of commutators of the phase of high-frequency radiating elements. The commutation of the radiating elements is determined through the length of the interval of commutation (switching over) which is calculated in accordance with the formula A = B - C sin alpha, where B and C are the values constant for each concrete antenna, and alpha is the declination of the cophasal front of the beam with relation to the plane of the array and the supply of the radiating elements occurs both in parallel and in sequence through a waveguide along which there are arranged the radiating elements. Author (TAB)

N67-21361# Teledyne, Inc., Alexandria, Va. Earth Sciences Div.
LASA AMPLITUDE SCATTER
D. E. Frankowski 2 Nov. 1966 17 p Prepared for Lincoln Lab., MIT
(Contract AF 19(628)-5167)
(LL-2; ESD-TR-66-586; AD-645332) CFSTI: HC $3.00/MF $0.65

Seismic signal amplitude scatter is shown by demonstration to be characteristic of present seismic arrays rather than a unique characteristic of LASA. Author (TAB)

N67-21362# Illinois Univ., Urbana. Coordinated Science Lab.
ERROR CORRECTING CODES FOR COMPOUND CHANNELS
Hsung-Tsao Hsu Dec. 1966 104 p refs
(Contract DA-28-043-AMC-00073(E); Grant NSF GK-690)
(R-331; AD-644618) CFSTI: HC $3.00/MF $0.65

Cyclic codes of known classes today are either for burst error correction only or for random error correction only. By careful observation, a typical communication channel is disturbed by both types of errors, burst errors and random errors, but not simultaneously. By definition, a communication channel is called a compound channel if it is disturbed by both types of errors, but not simultaneously. In this thesis, an extensive study of cyclic codes as error correcting codes for compound channels was made. Decoding procedures for compound channels are briefly discussed. Many calculated numerical results are also presented. Author (TAB)

N67-21429# Teledyne, Inc., Alexandria, Va.
TRAVEL-TIME ANOMALIES AT LASA
D. E. Frankowski and F. A. Klappenberger 2 Nov. 1966 55 p ref Prepared for Lincoln Lab., MIT
(Contract AF 19(628)-5167; ARPA Order 512)
(LL-1; ESD-TR-66-585; AD-645331) CFSTI: HC $3.00/MF $0.65

World-wide average travel-time curves are inadequate to permit optimum phasing of teleseismic signals. Phase alignment corrections in the form of station relative travel-time anomalies of LASA, based on approximately 350 events, are presented. Author (TAB)

N67-21432# Lincoln Lab., Mass. Inst. of Tech., Lexington.
RADAR LOCATION FOR COMPLETE COVERAGE OF REPRESENTATIVE THREAT-VOLUMES
Samuel D. Ewing, Jr. and David Caldwell 15 Aug. 1966 37 p
(Contract AF 19(628)-5167; ARPA Order 498)
(TR-422; ESD-TR-66-413; AD-644826) CFSTI: HC $3.00/MF $0.65

A radar is constrained to scan within a volume of space modeled as a cone with the apex at the radar. The threat-volume is modeled as the frustum of a right-circular cone inverted on a flat earth with a vertical axis and with the height equal to the maximum acquisition altitude. Threatening objects can enter anywhere within this volume above some specified minimum re-entry angle that determines the apex angle of the frustum. The problem solved is that of finding the minimum surface range of the radar that permits the entire frustum volume to be included within the given scanning cone. The important special case of a point impact zone (base radius of frustum approaches 0) is also discussed. Results are presented showing how this minimum distance is affected by changing (1) the minimum re-entry angle, (2) the scan angle, (3) the maximum radar acquisition altitude, and (4) the impact-zone radius. Effects of earth curvature are also discussed. These results are useful as one aspect of optimizing radar location in terminal defense studies. Author (TAB)

N67-21444*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
PHYSICAL CONSTANTS AS DETERMINED FROM RADIO TRACKING OF THE RANGER LUNAR PROBES
W. L. Sjogren, D. W. Trask, C. J. Vegos, and W. R. Wollenhaupt 30 Dec. 1966 28 p refs
(Contract NAS7-100)
(NASA-CR-83112; JPL-TR-32-1057) CFSTI: HC $3.00/MF $0.65
CSCL 17I

Estimates of the GM of the Earth and Moon, the tracking-station locations and the lunar radii at the various impact points, derived from the reduction of Earth-based radio-tracking data from the Ranger lunar missions, are reported. The estimates are consistent and compare favorably with other work. The results and limitations of the current analysis and projected improvements for follow-on analysis are discussed, as well as the theoretical model, the estimator, the data quality and quantity, and the data fit. Author

N67-21554# Central Lab. for Radiological Protection, Warsaw (Poland).
TEMPERATURE DEPENDENCE OF FET AMPLIFIERS USED WITH JUNCTION DETECTORS
W. Katkiewicz 1966 8 p refs
(CLOR-52/D)

The energy resolution of the FET input stages of amplifiers used in conjunction with junction detectors was investigated in the temperature range +30 to −70°C. For 2N2500 and 2N3277 input stages the increase in resolution was about 0.5% C^{-1} with decreasing temperature. This was the result of a drop in the thermal channel noise as well as increase of FET transconductance g_m. Author (NSA)

08 COMPUTERS

Includes computer operation and programming; and data processing. For basic research see: 19 Mathematics.

N67-20597# Computer Research Corp., Newton, Mass.
MAGIC PAPER: AN ON-LINE SYSTEM FOR THE MANIPULATION OF SYMBOLIC MATHEMATICS Final Report
Lewis C. Clapp, Dale E. Jordan, Ellen J. Wax, and Robert S. Wolf 15 Apr. 1966 67 p
(Contract AF 19(628)-5098)
(R-105-1; AD-643313) CFSTI: HC $3.00/MF $0.65

The report describes the preliminary version of the MAGIC PAPER System. Through a conversational interaction, the system aids the scientist, engineer or mathematician as he performs symbolic operations on linear algebraic equations. The user begins by entering his initial equations and conditions through a mathematical

keyboard. As he types these equations, they are displayed on a flicker-free scope in standard mathematical notation. Using a push-button control panel and a light pen, he may select expressions and operations which are to be performed on them. If the operation is legal, the system generates a new equation which is then added to the scope display. With the basic set of operations, the user may create new operators which can then be added to the system. He can also introduce special notational conventions. The user has considerable control which enables him to personalize the system to meet his own particular needs. Author (TAB)

N67-20605# Westinghouse Electric Corp., Baltimore, Md. Surface Div.

SELF-REPAIR TECHNIQUES INVESTIGATION Quarterly Report, 1 Jun.–31 Aug. 1966

Howard S. Fitzhugh, II, Charles G. Masters, Jr., and William C. Roberson Nov. 1966 35 p refs

(Contract DA-28-043-AMC-02343(E))

(MDE-1404; ECOM-02343-1; QR-1; Rept.-1; AD-643223) CFSTI: HC $3.00/MF $0.65

The objective of this contract is the assimilation and development of a compatible set of techniques which can be used to design and construct self-repairing digital systems. The objectives of this phase of the contract were to perform studies in the areas of error detection techniques and parallel processing as applied to digital systems. The progress to date by the contractor has been to perform an error detection study utilizing residue codes and An + B codes. Through the use of residue codes it has been demonstrated both mathematically and diagramatically how errors could be detected in a 24-bit arithmetic unit, when these errors occur during an addition and multiplication processes as well as transfer/storage processes. The application of these techniques to the division process remains to be investigated; if achieved, it will represent a significant achievement in the area of error detection and correction in a division unit. Author (TAB)

N67-20607# Navy Underwater Sound Lab., New London, Conn.

IBM 704 COMPUTER CIRCUIT ANALYSIS PROGRAM NO. 0400

Henry Weinberg 1 Nov. 1966 38 p refs

(USL-751; AD-644203) CFSTI: HC $3.00/MF $0.65

The Circuit Analysis Program was prepared for the IBM 704 computer and is written in the FORTRAN and SAP-FORTRAN languages. In this report, the program is used to analyze R-L-C (resistance, inductance, and capacitance) electric networks and, once the proper analogies are made, resolve problems relative to obtaining eigenvalues and roots of polynomials and solving systems of general linear equations. Examples of some of the above problems are provided. The total number of equations for each problem cannot exceed 30. Accuracy of the solution is improved by using two 36 binary bit words to represent each number, but execution time is sacrificed. The requestor controls the format used to read the equation parameters; thereby, the flexibility of the program is increased, and the possibility of transcribing errors is reduced. Three methods for evaluating a determinant with quadratic elements were tried, and it was decided that the method of false position is the most effective because of its advantageous storage and time requirements and greater accuracy. Author (TAB)

N67-20677# Air Force Systems Command, Kirtland AFB, N. Mex. Air Force Weapons Lab.

TIDY, A COMPUTER CODE FOR RENUMBERING AND EDITING FORTRAN SOURCE PROGRAMS Technical Report, Jul. 1965–Jun. 1966

Harry M. Murphy, Jr. Oct. 1966 101 p refs

(AFWL-TR-66-93; AD-642099) CFSTI: HC $3.00/MF $0.65

TIDY is a FORTRAN computer code that renumbers and edits other FORTRAN source programs whose statement numbering has become unwieldly and whose readability has deteriorated as a result of the many revisions, patches, and corrections that are typical of reworked programs. TIDY processes programs routine-by-routine and punches new versions of the programs with the following characteristics: (1) All statement numbers increase in consecutive order; (2) Only statements referred to by other statements retain statement numbers; (3) All statement number references are updated to conform to the numbering scheme; (4) All FORMAT statements are collected and appear at the end of each routine; (5) All FORMAT and CONTINUE statements that are not referenced are deleted; (6) Blanks are inserted in the FORTRAN statements to improve the readability of the statements, while excessive blanks in the statements are deleted; (7) Comments are processed to delete excessive blank comments and to eliminate comments from the FORTRAN statement number and continuation fields; and (8) All cards are labeled with a unique letter-number combination. TIDY is entirely written in ASA FORTRAN and accepts and processes all ASA FORTRAN statements as well as some IBM and CDC dialect statements. Author (TAB)

N67-20704# Air Force Systems Command, Wright-Patterson AFB, Ohio. Air Force Materials Lab.

MACHINE COMPUTATION OF NUCLEAR MAGNETIC RESONANCE SPECTRA Final Report, 1 Jan.–10 May 1966

H. A. Rush Aug. 1966 43 p refs

(AFML-TR-66-196; AD-643775) CFSTI: HC $3.00/MF $0.65

A modified computer program (NMRP) is described for the computation of theoretical nuclear magnetic resonance spectra with up to seven nuclei of spin one-half. This program provides a reduced set of spectral lines and a printer display plot of the spectrum in addition to output provided by the program from which it was derived. Author (TAB)

N67-20715# RAND Corp., Santa Monica, Calif.

SOVIET CYBERNETICS TECHNOLOGY. VIII: REPORT ON THE ALGORITHMIC LANGUAGE ALGEC

Wade B. Holland Dec. 1966 149 p refs

(Contract AF 49(638)-1700; Proj. Rand)

(RM-5136-PR; AD-644869) CFSTI: HC $3.00/MF $0.65

A translation of the final version of the new Soviet Algorithmic Language for Economics Problems (ALGEC), a general-purpose computer programming language that can use both Latin and Cyrillic alphabets and either Russian or English reserved words. Based on ALGOL 60 and SUBSET ALGOL 60, ALGEC has been modified to permit the handling of tables, records indexes, etc., and documents of complex format and variable length; and to provide a means of selecting and processing individual items from such documents and from nonnumerical textual matter. Ideas and input-output procedures were taken from COBOL-61. The Memorandum includes a translation of M. Koroleva's article on the development of ALGEC; a brief biographical note on the Russian authors and editor; a Russian-English glossary of ALGEC terminology; and an English-Russian glossary included in an index to definitions of terms and syntactic units. A bibliography of RAND publications on Soviet cybernetics and computer technology is appended. TAB

N67-20881# Westinghouse Electric Corp., Pittsburgh, Pa. Bettis Atomic Power Lab.

GRAPHIC DISPLAY OF NUMERICAL DATA

D. J. Di Leonardo Apr. 1966 38 p

(Contract AT(11-1)-GEN-14)

(WAPD-TM-611) CFSTI: HC $3.00/MF $0.65

Four computer programs that use projection equations to develop perspective, stereographic, isometric, and horizontal (contour) projections from PDQ-5 output tape or from data stored on tape in PDQ-5 format are described. Stereo (MO730) draws

perspective and stereographic views of PDQ-5 neutron flux and power; MO637 draws isometric views of PDQ-5 neutron flux and power; MO682 draws isometric views of PDQ-5 isotope concentration distributions; MO694 draws contour plots of PDQ-5 neutron flux and power. The graphic displays are developed by means of a line plotter or a cathode ray tube using output from the PDQ-5 neutron diffusion theory program. Input instructions to the Fortran programs that use the projection formulas developed are detailed in the appendixes. NSA

N67-20897# Naval Radiological Defense Lab., San Francisco, Calif.

MONTE CARLO TECHNIQUE APPLIED TO THE CALCULATION OF GAMMA-RAY TRANSPORT IN COMPARTMENTED STRUCTURES

L. G. Haggmark 3 May 1966 31 p refs
(USNRDL-TR-1038; AD-637685) CFSTI: HC $3.00/MF $0.65

A Monte Carlo computer code was assembled to calculate the transport of gamma rays in three-dimensional, rectangular geometry. The code uses the statistical estimation technique to compute the flux and dose at several space points. The code was applied to two compartmented iron structures that had been experimentally investigated. The Monte Carlo and experimental results compare well, i.e., within 20%, in most cases. In a few cases for one structure, where the radiation was incident at large angles from the normal to one wall, the comparison between the results was less satisfactory. The experimental value was a factor of 6 greater than the Monte Carlo value in the worst case. Author (NSA)

N67-21051# Wolf Research and Development Corp., Bladensburg, Md. Applied Sciences Dept.

UNIFIED GEODETIC PARAMETER PROGRAM (GEOPS), VOLUME II Final Technical Report, 8 Dec. 1964–25 Mar. 1966

T. H. Rau, P. M. Mason, and G. E. Prine 25 Mar. 1966 96 p refs
(Contract DA-44-009-AMC-878(X))
(AD-640322) CFSTI: HC $3.00/MF $0.65

The report presents a complete description of the programming aspects of the GEOPS program. Written in FORTRAN IV for the IBM-7094 computer, the program utilizes full core storage and ten magnetic tapes during its execution. The glossary of symbols contains all those important to the computational logic. Program flow is described both from an overall and from an individual routine viewpoint. Compilation procedures, computational logic, and input-output specifications are presented. The reader should, at any time, have reference to an actual listing of the program. Two associated, supplementary programs, an equinox tape generator and an input data pre-processor, are also described in this report. Author (TAB)

N67-21172 Joint Publications Research Service, Washington, D. C.

ADMINISTRATIVE EFFICIENCY AND COMPUTERS

E. A. Isayev 14 Feb., 1967 33 p Transl. into ENGLISH of the book "Effektivnost' Upravleniya i Elektronnyye Mashiny" Moscow, Znaniye Publishing House, 1966 p 3–32
(JPRS-3985; TT-67-30543) CFSTI: HC $3.00

A journalistic account of using digital control computers in systems capable of automating the administration of enterprises is presented. Types of industrial systems, and the gathering, transmitting, and processing of information are outlined. The details of production within the plant and prediction of market needs are mentioned. Computers are briefly described and flexibility in decision making is considered. Examples are discussed using a parts machining plant and a bakery as illustrations. N.E.N.

N67-21320# International Computers and Tabulators, Ltd., Stevenage (England).

DESIGN PROCEDURES FOR A MULTI-ELEMENT FLUIDIC PLATE USING WALL-ATTACHMENT DEVICES

D. Hawgood, W. C. Morton, B. J. Steptoe, and S. Ties [1967] 12 p refs Presented at the 2d Cranfield Fluidics Conf., Cambridge, Engl., 3–5 Jan. 1967 Sponsored by the Min. of Technol. *Its* Paper H3
CFSTI: HC $3.00/MF $0.65

The specification of characteristics of wall-attachment devices for use in integrated arrays is discussed. Pulse stretching effects produced by OR/NOR gates and interconnections are described, and the way in which these may influence logic design is discussed. Transient reflection effects in integrated interconnections are described. Experimental data on losses in straight channels and right angle bends is presented. A discussion of manufacturing techniques and reasons leading to the choice of epoxy replication are given. The way in which this technique has been used to manufacture arrays of 10 elements is described. Results of dynamic measurements on these arrays are presented. Author

N67-21401 Polish Academy of Sciences, Warsaw. Inst. of Nuclear Research.

AN UNIVERSAL DEVICE FOR RECORDING OF EXPERIMENTAL RESULTS IN NUCLEAR PHYSICS MEASUREMENTS [UNIWERSALNE URZADZENIE DO REJESTRACJI DANYCH POMIAROWYCHL W EKSPERYMENTACH FIZYKI JADROWEJ]

1966 33 p refs In RUSSIAN; ENGLISH summary
(INR-735/VI/E) CFSTI: $3.00

The construction of the universal apparatus for registering the data from multi channel systems applied in nuclear physics is described. The work parameters obtained by means of this apparatus are also discussed. This system was applied in particular to registering the experimental data from the 34-channel time analyzer and the 450-channel hedoscope. Author

N67-21487# California Univ., Berkeley. Lawrence Radiation Lab.

COMPUTER-CONTROLLED FAST-LOGIC CIRCUITS

H. G. Jackson, Fred Kirsten, and Dick A. Mack 7 Sep. 1966 18 p refs Presented at the 1966 Intern. Conf. on Instrumentation for High Energy Phys., Stanford, Calif., 9–12 Sep. 1966
(Contract W-7405-ENG-48)
(UCRL-17112; CONF-660918-9) CFSTI: HC $3.00/MF $0.65

The extent to which a computer can be used to relieve the experimenter of the time consuming and exasperating routines of establishing, recording, and maintaining the operation of instrumentation for high-energy physics experiments is discussed. The design of future fast-logic circuits and their associated computer control is investigated. NSA

N67-21553# General Dynamics Corp., San Diego, Calif. John Jay Hopkins Lab. for Pure and Applied Science.

CONSTRUCTION OF STATISTICAL RESONANCES IN THE UNRESOLVED RESONANCE REGION: THE PSEUDO CODE

M. W. Dyos 26 May 1966 31 p refs
(Contract AT(04-3)-167)
(GA-7136) CFSTI: HC $3.00/MF $0.65

A description is given of the PSEUDO code for the construction of statistical resonances in the unresolved resonance region. The code will construct resonance parameters, using random sampling techniques, which can be punched out on cards for use as input to a slowing-down code. Author (NSA)

N67-21727# Wolf Research and Development Corp., West Concord, Mass.

GENERALIZED BANDWIDTH COMPRESSION AND ATTRIBUTE EXTRACTION USING THE EXPERIMENTAL DYNAMIC PROCESSOR AND DISPLAY SYSTEM Final Report, Oct. 1, 1964–Sep. 30, 1966

J. Richard Wright, Richmond G. Albert, Jerome M. Cohn, Virginia M. Flynn, Marilyn M. Heavey et al 30 Sep. 1966 84 p
(Contract AF 19(628)-4392)
(AFCRL-66-751; AD-644822) CFSTI: HC $3.00/MF $0.65

A completely new version of the Attribute Extraction program for the Experimental Dynamic Processor is described. The size of symmetric matrices which can be diagonalized has been increased from 160 to 224. Special display programs, including a visual documentation system, are briefly described. A special eigenvalue-eigenvector evaluation technique, preliminary results of the display processor beam characteristics study, and a method for bandwidth compression of binary data are presented. Author (TAB)

N67-21755# European Atomic Energy Community, Ispra (Italy).

COUNTERS COUNTING IN ANY CODE

M. Combet 1967 39 p refs
(EUR-3268.e) CFSTI: HC $3.00/MF $0.65

A simple method for designing a sequential network is described. Provided a sequence of numbers, written by binary code, the method allows the design of the corresponding circuit made of JK flip-flops. Four examples are given for some sequences, one of which is for a decimal counter. An extension to ripple-through counters is applied to decimal counters. Author

N67-21762# Royal Aircraft Establishment, Farnborough (England).

CONTROL ARRANGEMENTS FOR ON-LINE OR OFF-LINE OPERATION OF AN INCREMENTAL PLOTTER IN THE MERCURY COMPUTER SYSTEM

K. Sanderson Sep. 1966 22 p refs
(RAE-TR-66285) CFSTI: HC $3.00/MF $0.65

A digital incremental plotter has been incorporated into the Mercury computer system. Two plotting facilities have been provided—direct on-line operation from the computer and off-line operation from computer output recorded on magnetic tape. The report is primarily concerned with the control arrangements provided to implement the new facilities. Outlined characteristics and operation of the plotter are also given. Author (ESRO)

N67-21824# Du Pont De Nemours (E. I.) and Co., Aiken, S. C. Savannah River Plant.

AXIAL POWER MONITORING WITH AN ON-LINE COMPUTER

T. J. Hurley, Jr. Jun. 1966 9 p refs Presented at the Am. Nucl. Soc. Meeting, Denver, 20–23 Jun. 1966
(Contract AT(07-2)-1)
(DPSPU-66-30-2; CONF-660606-17) CFSTI: HC $3.00/MF $0.65

One-line computer programs for a production reactor were developed for rapid determination of axial power distribution and calculation of the safety factor for film-boiling burnout of fuel surfaces. These programs operate concurrently to provide continual axial power monitoring and alarm functions. In use for over a year, the system has demonstrated speed and accuracy in gathering data, solving complex equations, and displaying useful information. It has thus been possible to operate closer to operating limits with added assurance of an adequate margin of safety. Author (NSA)

N67-21850# RAND Corp., Santa Monica, Calif.

THE QUEENS GRAMMAR

Stephen L. Lieman Jan. 1967 47 p refs
(Contract AF 44620-67-C-0045; Proj. Rand)
(RM-5209-PR; AD-645451) CFSTI: HC $3.00/MF $0.65

The famous eight-queens problem is presented and then generalized into a language over strings of integers. Various formalisms are shown to be able to describe this language, including arithmetical relations defined on each pair of integers in the string, programs for actually generating and parsing strings in the language, and a relational grammar. It is shown that context-sensitive grammar and transformational grammar are likely to be capable of defining the language. The simplicity and elegance of the arithmetical formulation and the computer programs that are easily derived from it are contrasted to the counterintuitive properties of relational grammars, context-sensitive grammars and transformational grammars that define the same language. A natural language counterpart to the Queens Language is given, and new measures of linguistic adequacy are defined. The implications of these new measures of adequacy to efforts for finding appropriate linguistic formalisms is discussed. Author (TAB)

N67-21854# Army Nuclear Defense Lab., Edgewood Arsenal, Md.

A SOURCE-ENERGY INTEGRATION PROGRAM DESIGNED TO OPERATE THE NHM CODE OUTPUT

Joseph Lacetera Jan. 1967 81 p Sponsored by DASA
(NDL-TM-35; AD-645929) CFSTI: HC $3.00/MF $0.65

The Los Alamos Scientific Laboratory (LASL) is preparing a Neutron-Gamma Monte Carlo (NGM) transport code that will provide differential data for use in mapping the initial radiation environment created by a nuclear detonation. The NGM output provides fluxes at a series of detectors, normalized to one neutron which leaves the source in the given source-energy solid-angle group. By appropriately weighting the output and integrating it with respect to the variables, the radiation field of given weapons can be mapped. A set of codes has been generated at the US Army Nuclear Defense Laboratory to integrate the fluxes over the variables (source energies and angles, detector energies, angles, and times), with appropriate weighting where necessary to provide input for special problems. This report describes a digital computer program written for the GE 225 computer (16K core storage and 6 magnetic tape drives) in the General Assembly Program (GAP) language. The program integrates the LASL NGM radiation transport code differential flux output with the source-energy variable weighted by a user-supplied function. The resultant output is the flux at the detectors due to the user-supplied source-energy spectrum. The method of performing the weighted source-energy integration operation and the use of checksums to minimize error are given through the use of a flow diagram with complementary textual description, and the GAP source-deck listing. The method of running the program and how to respond to the error signals is also described. Author (TAB)

N67-21855# Ballistic Research Labs., Aberdeen Proving Ground, Md.

A MACHINE CODE FOR THE UNFOLDING OF PULSE HEIGHT SPECTRA

Juergen K. Bock and John V. Lanahan Sep. 1966 99 p
(BRL-MR-1790; AD-645283) CFSTI: HC $3.00/MF $0.65

A FORAST machine code was developed for the unfolding of gamma and neutron pulse height spectra measured by means of a stilbene crystal at two different electronic gain settings. The code utilizes spectrum stripping routines based on logical decisions, is self-adapting to the input data, and requires little machine time on the high-speed digital computer BRLESC. Author (TAB)

N67-21870# California Univ., Berkeley. Operations Research Center.

MULTIOBJECTIVE LINEAR PROGRAMMING Research Report

David Savir Nov. 1966 38 p refs
(Contract Nonr-222(83); Grant NSF GP-4593)
(ORC-66-21; AD-642822) CFSTI: HC $3.00/MF $0.65

A linear program is considered with several objective functions. The traditional approach has been either to 'trade off' by weighting each function, or if a 'trade off' vector cannot be provided to ignore all but the most significant, the author is interested in classes of program whose members possess some common characteristics. Examples are sequences of production, refining, inventory problems over time at one installation. If sufficient conditions exist an estimate of a 'trade-off' vector can be made. This estimate improves over the sequence. A set X^* exists which contains the solutions obtained by optimizing with respect to all nonnegative combinations of objective functions. A decision maker is not indifferent to these solutions but can characterize preferred solutions. A method is presented whereby he can direct a finite sequence of solutions over X^* towards a preferred solution. As the estimate of the 'trade-off' vector improves, the expected length of the sequence diminishes, and the efficiency of solution increases. Author (TAB)

09 ELECTRONIC EQUIPMENT

Includes electronic test equipment and maintainability; component parts, e.g., electron tubes, tunnel diodes, transistors; integrated circuitry; microminiaturization. For basic research see: 10 Electronics. For related information see also: 07 Communications and 21 Navigation.

N67-20439# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

A PHASE DEMODULATOR OF THE SECOND HARMONIC WITH WIDTH MODULATION

V. Ju. Vorobkevic, I. S. Daniljuk et al 30 Mar. 1966 16 p refs Transl. into ENGLISH from Slaboproudy Obzor (Prague), v. 25, no. 1, 1964 p 21–24

(FTD-TT-65-1616; TT-66-62521; AD-641110) CFSTI: HC $3.00/MF$0.65

The properties of a phase demodulator of the second harmonic with width modulation are investigated. The demodulator considered here needs only small signal power with a sufficient zero stability and yields a high power gain. The most important results of the theoretical investigations and of the experimental verification of the demodulator response (transfer coefficient, zero point stability, dynamic properties) are stated. Author (TAB)

N67-20460 Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

CIRCUITS OF PARAMETRON FREQUENCY DIVIDERS

V. P. Komolov *In its* Moscow Univ. Herald. Ser. III. Phys. Astronomy 7 Dec. 1966 p 1–5 refs (See N67-20449 10-16) CFSTI: HC $3.00

The proposed divider effectively filters the undesirable pump frequency at the output (up to 30 dB), preserves parametric oscillations over a wide range of frequencies and has the possibility of working with extremely low values for the required energy and with high efficiency (up to 90%) in so far as the parametron works in the zone of inverse voltage of the diode, and therefore it possesses very great input resistance. The parametric generator had two outputs, one for connecting the following parametron and the other for oscillographic control and measurements. A conclusion is drawn that the parametron cascade frequency dividers do not present complexities and are stable and simple in adjustment. Simultaneously with such intermediate amplification circuits, a practical design for frequency dividers with a sufficiently high multiplicity division factor is possible. The cascade parametron divider is a system with many stable conditions distinguished by a stationary oscillation phase read off from the pumping phase. Author

N67-20536# Philco Corp., Blue Bell, Pa. Applied Research Lab.

METAL BASE TRANSISTOR II Final Report, 1 Jul. 1964–30 Jun. 1965

Walter Kane and Lincoln Hershinger Jul. 1966 71 p refs

(Contract DA-28-043-AMC-00161(E))

(Rept.-4; A051-F; ECOM-00161-F; AD-642524) CFSTI: HC $3.00/MF$0.65

The mean-free-path of electrons in several metal films was determined and found to be independent of deposition rate and substrate temperature. The minimum thickness for continuity of such films was also found to be independent of substrate temperatures, and varies with deposition rate only for low rates. Values of mean-free-path and minimum thickness are given. It is indicated that the very low values of t sub min/hot-electron mean-free-path necessary for a high-gain metal-base transistor are not likely to be obtained. The characteristics of the triodes fabricated during this program have been analyzed, and it has been concluded that the important gain mechanism is the control of current flow through a grid-like structure, formed by a partially agglomerated base film. The control of composition gradient in ZnCdS films is seen to permit fabrication of thin-film Schottky diodes having predictable barrier heights, yielding a method of controlling diode characteristics. Author (TAB)

N67-20545# Northrop Corp., Newbury Park, Calif. Nortronics Div.

TRANSIENT RADIATION VULNERABILITY OF MONOLITHIC BINARY CIRCUITS Final Report, Nov. 1965–Jun. 1966

William W. Chang, Edward J. Steele, James P. Raymond et al Griffiss AFB, N. Y., RADC, Sep. 1966 148 p refs

(Contract AF 30(602)-3589)

(ARD-66/45R; RADC-TR-66-433; AD-640821) CFSTI: HC $3.00/MF$0.65

An investigation was made to experimentally determine the pulsed ionizing radiation vulnerability of critical computer binary circuits, and study basic radiation-induced failure mechanisms. The test specimens were three bipolar transistor circuits fabricated by the monolithic integrated circuit technique, and one metal-oxide-semiconductor (MOS) integrated circuit. Experimental studies consisted of determining electrical circuit performance, and induced transient responses when exposed in a pulse ionizing radiation environment. Failure mechanisms were related analytically, where possible, to the characteristics of the circuit, and to electrical parameter degradation. Two failure modes were observed in the binary circuits. Transient response at circuit logic outputs was of sufficient magnitude to temporarily obscure the logic state of the circuit. Additionally, the intense radiation environment was sufficient to cause a radiation-induced change-of-state, with a permanent loss of stored information in the circuit. Electrical parameter degradation of the bipolar transistor circuits was insignificant after exposure to approximately 10,000 rads (Si). However, significant variations in circuit performance were observed for the MOS circuits when exposed to the same ionizing radiation intensities. Author (TAB)

N67-20552# General Electric Co., Auburn, N. Y. Semiconductor Products Dept.

A PRODUCT ENGINEERING MEASURE FOR THE IMPROVEMENT OF PRODUCTION TECHNIQUES TO INCREASE THE RELIABILITY AND TO IMPROVE PRODUCT CAPABILITY OF HIGH VOLTAGE MINIATURE SILICON RECTIFIERS Final Progress Report, 30 Dec. 1964–30 Jun. 1966

W. R. Comstock, P. C. Whitman, R. R. Schall, and E. G. Tefft 30 Jun. 1966 142 p refs

(Contract DA-36-039-AMC-06157(E))

(AD-643030) CFSTI: HC $3.00/MF$0.65

Experimental results support the hypothesis that reduction in peak surface field will result in improved life test survival. A

pellet design was chosen based on the required surface field. Theoretical calculations were made to determine the bevel angle for this design. Improved performance during reverse recovery has been obtained by using N-type silicon to permit gradual decay in reverse recovery current. A model for the origin of snapback failure has been proposed. A new technique for glass encapsulation was developed, which has lowered reverse leakage currents and in combination with a new etching technique has improved the device reliability. A new slug - lead was designed and tested which exhibits improved thermal resistance and lead fatigue over the original design. Several pieces of production equipment were designed and proven operational, based on the improvements made in the subject rectifier. The improved device has met the reliability objectives of the contract. The comparison of the new A14 device with the original A13 device shows a 50 to 1 failure rate improvement at 92C. junction temperature at 90% Confidence. The Environmental and Reliability Specification was approved and the improved rectifier has been tested to the various conditions and limits with good results. Test sequencing as required for acceptance produced some unexpected failures in lead fatigue and surge. Author (TAB)

N67-20586# SFD Labs., Inc., Union, N. J.
MINIATURE MICROWAVE NOISE GENERATOR Final Report
H. L. McDowell May 1966 50 p refs
(Contract DA-49-186-AMC-55(D))
(AD-642188) CFSTI: HC $3.00/MF $0.65

The interaction space is made reentrant so that the space charge may continually circulate around the device. The surface opposite the slow wave circuit is a secondary emitting cathode which is capable of emission around its full circumference. A thermionic priming source is included in the device and located flush with the cathode in the region known as the drift space. Feedback through recirculation of the electrons is avoided by employing a drift space having a smooth anode surface in place of the slow wave circuit. In the absence of phase focusing forces from the anode circuit wave, the space charge in a crossed-field amplifier rapidly debunches. This effect also prevents regeneration and a consequent periodicity in a noise generator spectrum. The operation of this device as a noise generator depends on a fundamental instability of the space charge which arises from a slipping stream interaction. This mechanism amplifies the noise energy present at the potential minimum by a large factor. The noise energy is then coupled to the slow wave circuit located on the anode side of the interaction space. Conventional crossed-field amplifier interaction then further amplifies the noise energy. TAB

N67-20598# Fairchild Semiconductor Corp., Mountain View, Calif.
UHF INTEGRATED CIRCUIT TECHNOLOGY Quarterly Report, 15 Apr.–15 Jul. 1966
J. A. Archer and G. M. Purnaiya Nov. 1966 21 p refs
(Contract DA-28-043-AMC-01813(E))
(ECOM-01813-1; Rept.-1; QR-1; AD-642593) CFSTI: HC $3.00/MF $0.65

The report discusses the design of a silicon monolithic UHF integrated amplifier. A transistor having an f sub T of 3.3 GHz, intended for use in integrated circuits, has been designed and the y-parameters computed over a wide range of frequencies. Fabrication techniques to be used in the construction of the amplifier are summarized. A computer program has been prepared to obtain the y-parameters of the transistor, modified by the addition of an arbitrarily complex network including isolation capacitance, collector series resistance, biasing, RC coupling networks, etc. The computer program has been used to obtain the performance characteristics of a common-emitter, RC-coupled amplifier. A biasing scheme and possible layout of the circuit are given. Author (TAB)

N67-20616# Research Triangle Inst., Durham, N. C.
INTEGRATED SILICON DEVICE TECHNOLOGY. VOLUME XII: MEASUREMENT TECHNIQUES
B. M. Berry Sep. 1966 224 p refs
(Contract AF 33(615)-1998)
(ASD-TDR-63-316, Vol. XII; AD-643610) CFSTI: HC $3.00/MF $0.65

Methods for determining the most common physical/electrical properties of silicon or devices made from silicon are described in this report. These measuring methods are grouped under four general headings: starting material evaluation, process parameter evaluation, device electrical evaluation, and device thermal evaluation. ASTM and other published standards are cited where applicable. For certain measurements these referenced standards are the only methods given; for others, alternative methods are also described in detail; and for still other measurements, no adequate standards exist. In the latter case the procedures given here have been developed from what seems to be common practice and sense. Author

N67-20651# Frankford Arsenal, Philadelphia, Pa.
DEVELOPMENT AND QUALIFICATION OF IGNITION ELEMENT, ELECTRICAL, XM47 Technical Research Report, Nov. 1964–Mar. 1966
Alonzo E. White Wright-Patterson AFB, Ohio. Systems Eng. Group, Oct. 1966 41 p
(R-1827; SEG-TR-66-42; AD-643950) CFSTI: HC $3.00/MF $0.65

This report covers the development and qualification testing of the XM47 electrical ignition element. The element has redundant firing circuits, is functional over the temperature range of -65 to 400 F, and will not fire when subjected to one ampere/one watt of electrical energy. Presented are the element design, qualification tests and data, and performance characteristics. TAB

N67-20667# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE DESIGN OF THE TYPE 914-4 OPERATIONAL AMPLIFIER WITH PARALLEL CHANNELS
Mo Yi 3 Aug. 1966 22 p refs Transl. into ENGLISH from Tzu Tung Hua Hsueh Pao (Communist China), v. 3, no. 3, 1965 p 142–150
(FTD-HT-66-198; TT-67-60244; AD-643927) CFSTI: HC $3.00/MF $0.65

Some considerations in the design of the type 914-4 operational amplifier with parallel channels are presented, where the improvement of the output stage, the removal of the third channel and the synthesis of the compensating network are dealt with in detail. A method of analyzing the branching characteristics of operational amplifiers with parallel channels using a computation diagram is presented. Methods of using a compensating network to improve low-frequency stability and the construction and application of the computation diagram are given in the appendix. Author (TAB)

N67-20684# Naval Civil Engineering Lab., Port Hueneme, Calif.
TRANSIENT-SUPPRESSION NETWORKS FOR ELECTRONIC EQUIPMENT Final Report, Jul. 1965–Jun. 1966
S. J. Wooten Jan. 1967 58 p refs
(R-506; AD-644867) CFSTI: HC $3.00/MF $0.65

Seventeen transient-suppression networks (4 active, 13 passive) were tested with the NCEL-developed 0-to-10,000-volt pulse generator in a program to develop protection for sensitive naval communications and computer equipment. The inductive and capacitive passive filters did not provide satisfactory protection to solid-state electronics equipment, but some commercially available

active transient-suppression networks gave satisfactory protection if their rated capacity was not exceeded. The best networks, in order of their performance, were (1) an AC-DC-AC filter system, (2) silicon controlled rectifiers, (3) a thyrector circuit, and (4) avalanche controlled rectifiers. The most satisfactory passive circuit was a complex, intermediate Pi-section band-pass network. However, although this and other passive circuits offer high reliability and long life, they are inefficient and cause excessive voltage drop with high loads. Active filter networks using silicon controlled rectifiers failed after prolonged application of transient voltages, but avalanche controlled rectifiers (which provided relatively poor attenuation of transients in the tests) did not fail under the same testing. Thyrectors failed under prolonged testing with transient pulses wider than 100 msec. Author (TAB)

N67-20724# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

COUPLED OSCILLATIONS OF CAVITY RESONATORS

L. A. Vaynshteyn 30 Sep. 1966 17 p refs Transl. into ENGLISH from Elektron. Bol'shikh Moshchnostey (Moscow), no. 3, 1964 p 216–230

(FTD-TT-65-1419; AD-643978) CFSTI: HC$3.00/MF$0.65

The article discusses some problems relating to the theory of coupled electromagnetic oscillations in cavity resonators. Section 1 investigates two resonators with rotational symmetry coupled through a small circular aperture in their common wall, the center of which aperture lies on the axis of rotation, for oscillations of the H sub 01 mode. The coupling coefficient in such a system is proportional to f(5) (where f is the aperture radius) and in the general case (analyzed in Section 2) the circular aperture provides the closest coupling and the coupling coefficient is proportional to f(3). Section 3 examines the oscillations in cavity resonators (waveguide sections) for which the coupling coefficient is arbitrary. Author (TAB)

N67-20737# California Univ., Livermore. Lawrence Radiation Lab.

DETERMINATION OF CHARGE SENSITIVITY OF A TUNNEL DIODE VOLTAGE THRESHOLD DISCRIMINATOR USED IN TIME DIFFERENCE MEASUREMENTS

P. D. Compton, Jr. and W. A. Johnson 10 Oct. 1966 30 p ref Presented at the 13th Ann. Nucl. Sci. Symp., Boston

(Contract W-7405-ENG-48)

(UCRL-14930-T; CONF-661020-1) CFSTI: HC$3.00/MF$0.65

The results of an investigation of the delay time variation of a tunnel diode (TD) threshold sensing discriminator are presented. These variations are a function of the square root of the input signal risetime and are accountable in terms of a charge sensitivity of the tunnel diode. A distinction is made between the charge sensitivity due to continuously rising signals and that due to short, low-energy pulses. A simple experimental method used for measuring the delay time variation as a function of the input signal risetime is described. The method is quite general and may be applied to any type of threshold discriminator. A theoretical model of the tunnel diode operating in the discriminator mode is developed. An equivalent circuit approach is used in this development by considering three phases of operation: before the TD reaches threshold, during the actual TD switching, and after the TD has fired. The model agrees with the experimental data, and it is concluded that the charge sensitivity model is a usefully valid concept which is applicable to the design and prediction of discriminator time-delay characteristics. Author (NSA)

N67-20776# California Univ., Livermore. Lawrence Radiation Lab.

FREQUENCY DOMAIN COMPENSATION OF COAXIAL CABLES FOR BEST TIME DOMAIN RESPONSE

Roger L. Peterson 17 Jun. 1966 45 p refs

(Contract W-7405-ENG-48)

(UCID-15023) CFSTI: HC$3.00/MF$0.65

Until the advent of extensive nuclear testing, broad-band losses in coaxial cable transmission systems were ignored. Most applications of such cable prior to testing were concerned with the absolute attenuation of narrow, band-limited signals. Most of the signals encountered in nuclear testing are single pulses having comparatively short risetimes. The frequency response of the transmission system is of interest from dc to approximately one Gc. This report is concerned with compensation in the frequency domain of the attenuation characteristics of high-quality coaxial cable of the type currently used in the field. In order to get an idea as to the problems involved in compensating such a cable, a piece of 7/8-inch Styroflex, 1011 feet long was obtained, tested and a compensator was built. Results of this experiment have led to more general conclusions about cable testing and compensation. Author (NSA)

N67-20808# Princeton-Pennsylvania Accelerator, Princeton, N. J.

A MODULAR ELECTRONIC SYSTEM FOR MAGNETOSTRICTIVE SPARK CHAMBERS

Thomas F. Droege 26 Oct. 1966 24 p refs Presented at the 13th Ann. Nucl. Sci. Symp., Boston

(Contract AT(30-1)-2137)

(PPAD-605E; CONF-661020-9) CFSTI: HC$3.00/MF$0.65

A flexible electronic system is described where each module performs a single function. The system was designed around a digital data buss which allows read-out by typewriter, magnetic tape, computer or combinations of these. Besides those associated directly with magnetostrictive spark chambers the system includes auxiliary modules such as scalers, pulse height to digital converters, event registers, and fixed data input so that all aspects of a particular event can be recorded. Sub modular techniques and integrated circuits reduce the required number of printed circuit boards and facilitate fabrication of special modules. Several operating systems are described. Author (NSA)

N67-20816# Commissariat a l'Energie Atomique, Saclay (France).

TEMPERATURE BEHAVIOR OF PHOTO-EMISSIVE FILMS: THE CASE OF PHOTO-MULTIPLIERS USED IN SCINTILLATION COUNTERS [COMPORTEMENT EN TEMPERATURE DES COUCHES PHOTOEMISSIVES.

Abdul-Hamid Ardalan (Ph.D. Thesis—Paris Univ., Orsay, France) 1966 102 p refs In FRENCH

(CEA-R-2995)

The changes in the spectral sensitivity of 3 types of normal photocathodes (Cs_3Sb, tri-alkali, and bi-alkali without cesium) as a function of temperature are investigated. The photocathodes of cathodes of commercial photomultipliers (DARIO, E.M.I., R.C.A., A.S.C.O.P.) were used for these tests. The temperature range studied was −25 to +55°C (except for the bi-alkali photocathodes which were tested up to +150°C) and the wave-length range was 3,250 to 7,000 Å. After a brief review of photo-electric effect theories, the experimental device is described and the measurement results presented. Finally, an interpretation of these results is proposed. Author (NSA)

N67-20857# Brookhaven National Lab., Upton, N. Y.

EXPERIMENTAL RESULTS ON THE RCA 7835, AND INITIAL OPERATING PARAMETERS OF THE FTH 515

J. T. Keane and A. J. McNerney [1966] 17 p Presented at the Linear Accelerator Conf., Los Alamos, N. Mex.

(Contract AT(30-2)-GEN-16)

(BNL-10650; CONF-661021-13) CFSTI: HC$3.00/MF$0.65

Performance testing results of the RCA 7835 super power triode and the Thompson–Houston 515 Vapodyne triode, which are to be used as rf power sources for the proton linac at BNL, are presented. NSA

N67-20911# United Kingdom Atomic Energy Authority, Harwell (England).

METHOD TO IMPROVE THE DIFFERENTIAL LINEARITY OF ANALOGUE DIGITAL CONVERTERS AND RELATED APPARATUS

E. Gatti, V. Svelto, and C. Cottini Jun. 1966 6 p Transl. into ENGLISH from Italian Patent No. 699271, 1965
(NP-TR-1427) CFSTI: HC $3.00/MF $0.65

A method is described for improving the differential linearity of analog-to-digital converters characterized by the fact that for classification of a set of pulses with a particular amplitude spectrum, where one fraction of them belongs to a given channel is determined, instead of always using the thresholds of the channel considered, by using pairs of thresholds related to a set of channels. These thresholds are obtained by translation of assigned quantities according to an assigned sequential or random law; this translation is taken care of by a correction made numerically for the coded value. NSA

N67-20961# California Univ., Livermore. Lawrence Radiation Lab.

LOCK-IN AMPLIFIER USED IN ATOMIC CROSS-SECTION MEASUREMENTS

Louis W. Ducote 23 Sep. 1966 33 p refs Presented at the Symp. on Eng. Probl. of Controlled Thermonucl. Res., Gatlinburg, Tenn. Submitted for publication
(Contract W-7405-ENG-48)
(UCRL-70016; CONF-661016-6) CFSTI: HC $3.00/MF $0.65

A system is described for the detection of signals in a noise background. Ionization, excitation, and polarization cross sections can be detected at low levels with the aid of instruments such as mass spectrometers, monochromators and phase-lock amplifier systems. The electronics used for this type measurement include the following: r-f source, wide-band amplifier, narrow-band amplifier, phase detector, phase shifter, integrator, d-c amplifier, mixer, multivibrator, and harmonic generator. These circuits and their characteristics are described. An a-c line-locked closed-loop system will also be described as part of the detection system. Author (NSA)

N67-21000# California Univ., Livermore. Lawrence Radiation Lab.

PROTECTION CIRCUITRY FOR THE ASTRON FAST PULSER

Milton D. Johnson 23 Sep. 1966 17 p Presented at the Symp. on Eng. Probl. of Controlled Thermonucl. Res., Gatlinburg, Tenn., 3–6 Oct. 1966 Submitted for publication
(Contract W-7405-ENG-48)
(UCRL-70021; CONF-661016-9) CFSTI: HC $3.00/MF $0.65

A hard-tube modulator was developed for the Astron fast pulsing system. The capacitor energy storage system consists of a 205-μF capacitor bank at 40,000 V, or a stored energy of 164,000 joules. The 3-phase generator, operating into a full-wave rectifier network, is capable of producing 4000 A under short circuit conditions. A General Electric Magne-blast circuit breaker removes the generator from the line in 0.1 sec or about five cycles. Circuitry was developed and resistors were placed throughout the capacitor bank to protect against bank reversal. Two 400,000-V ingnitrons were used in series across the bank. These ignitrons would handle the bank discharge current but their coulomb rating was not large enough to take the generator output for the 0.1 sec. Therefore, a vacuum switch was placed in parallel with the ignitrons. Design criteria, circuitry and results of the tests are reported. NSA

N67-21011# Brookhaven National Lab., Upton, N. Y.

TUNNEL DIODE PULSE SHAPE DISCRIMINATOR

Branko Soucek [1966] 15 p refs
(Contract AT(30-2)-GEN-16)
(BNL-10626) CFSTI: HC $3.00/MF $0.65

A pulse shape discriminator with wide dynamic range is described. The discriminator has been used for separating the scintillation signals from particles with different specific ionization, in connection with fast 56 AVP and RCA 7267 photomultiplier tubes. For the signal amplitudes in the range from 50 mV to 5 V, the time shift of the output discriminator pulse for a given sort of particles is about ±1 nanosec. The circuit has also been used for neutron spectrometry, using proportional counters, and for separation of thermal neutrons, with glass beads–plastic scintillators. Author (NSA)

N67-21135# International Computers and Tabulators, Ltd., London (England).

ELECTRICAL TRANSDUCERS FOR FLUIDIC SYSTEMS IN COMPUTER PERIPHERALS

D. Hawgood 5 Jan. 1967 11 p refs Presented at the 2d Cranfield Fluidics Conf., Cambridge, Engl., 3–5 Jan. 1967 Supported by the Min. of Technol.
(F3) CFSTI: HC $3.00/MF $0.65

Digital transducers to link fluidic to electronic systems must be cheap, reliable and as fast as the fluidic system. Possible types of electrical-to-pneumatic transducer are listed, and a transducer is described in which a fluidic element of low hysteresis is switched on each pressure pulse from a moving coil earpiece, switching at 500 cps for 100 mW input. Possible types of pneumatic-to-electric transducer are also listed, and the construction is described of a piezoelectric transducer, suitable for use with 500 cps pulses, giving 1 volt/psi output. An investigation has also been made of hole-sensing for punched cards using this type of transducer with both through-hole sensing and back-pressure sensing. Author

N67-21280# Marconi Co., Ltd., Chelmsford (England).

A PURE FLUID BINARY TO DECIMAL CONVERTER

B. G. Bryan [1967] 12 p refs Presented at the 2d Cranfield Fluidics Conf., Cambridge, Mass., 3–5 Jan. 1967
(H2) CFSTI: HC $3.00/MF $0.65

Various possible circuit designs for a binary-to-decimal converter are discussed, and the reasons are given for the selection of the particular circuit on which the development of this multilayer integrated logic block was based. Certain performance data are included, as are suggestions for further improvement. Wall attachment OR/NOR elements with reasonable gain and pressure recovery can be used in conjunction with passive elements to produce logic circuits that are economical in terms of air consumption. Author

N67-21323# Rome Air Development Center, Griffiss AFB, N. Y. Research and Technology Div.

THE EVOLUTION OF A MICROELECTRONIC IF AMPLIFIER

John E. McCormick Oct. 1966 23 p Presented at the Microelectron. Symp. Sponsored by the IEEE, St. Louis, 18–20 Jul. 1966
(RADC-SP-66-1; AD-644187) CFSTI: HC $3.00/MF $0.65

The amplifier discussed accomplishes a complete function and has characteristics which present a cross-section of the problems encountered in the microminiaturization of a variety of high frequency analog circuitry. The physical parameters of the various versions of the IF amplifier are summarized. The thin film unit has one three-hundredths the volume, one one-hundred and fiftieth the weight, and consumes one one-hundred and twentieth the power of the tube unit. The monolithic silicon unit will have from one third to one fifth the volume, possibly one-half the weight, and about one-half the power consumption of the thin film unit. The advantage of integrated silicon over thin film hybrid is not only size and weight reduction, but the increase in reliability that will result from such an approach. Author (TAB)

N67-21346# Federal Pacific Electric Co., Sanford, N. C. Cornell-Dubilier Electronics Div.
PRODUCTION ENGINEERING MEASURE FOR CAPACITORS, ELECTROLYTIC, ALUMINUM HIGH RELIABILITY Quarterly Report, Jun. 20–Sep. 20, 1966
J. E. Hand 14 Nov. 1966 14 p
(Contract DA-36-039-AMC-06189(E))
(QR-1; AD-642810) CFSTI: HC $3.00/MF $0.65

Several tests were completed on dielectric oxide film formation. Capacitors were assembled for impregnating electrolyte and paper system evaluations. Seal evaluation tests were started. TAB

N67-21368# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
WAVEGUIDE FREQUENCY DISCRIMINATOR
B. Novak 12 Sep. 1966 29 p refs Transl. into ENGLISH from Slaboproudy Obzor (Prague), v. 25, no. 6, 1964 p 353–361
(FTD-HT-66-157; AD-644008) CFSTI: HC $3.00/MF $0.65

The report describes a new solution of a waveguide frequency discriminator, its faulty voltage is derived from phase slides of the electromagnetic field during dissonance of impedance bound hollows. Explained is the principle of action of the discriminator, an accurate calculation of faulty voltage is carried out at dissonance of generator in the region of 3000 mc and derived were relations for a broad band discriminator. A design of the discriminator with waveguide cavity bound by the inductive slot is given. Author (TAB)

N67-21416 Canadian Armament Research and Development Establishment, Valcartier (Quebec).
NEW MICROWAVE SPECTROMETER CONCEPTS FOR UPPER ATMOSPHERIC MEASUREMENTS
A. J. Beaulieu Oct. 1963 37 p refs
(CARDE-TR-457/63) CFSTI: $3.00

The state-of-the-art in microwave spectrometers is briefly reviewed, and the basic elements of highly sensitive spectrometers are defined. Design aspects are examined, with consideration given to the use of a typically molecular characteristic and, to reduce error sources, the use of a characteristic of the interaction between electromagnetic fields and particles which differ from the inherent characteristic of the interaction between electromagnetic fields and of microwave circuit components. It is pointed out that such typically molecular effects as the Stark and Zeeman resulted in the development of field effect spectrometers. Particular emphasis is placed on the stimulated emission spectrometer which exploits the transient characteristics, and the saturation effect spectrometer which employs the saturation characteristics. In each case, it was found that a homodyne balanced bridge technique improves sensitivity provided the typically molecular effect is used in a periodic fashion so as to be separable from the balance error. The merits of different spectrometers are assessed, in relation to choosing a specific instrument for the measurements required. M.G.J.

N67-21433# Bulova Watch Co., Woodside, N. Y. Electronics Div.
PRODUCTION ENGINEERING MEASURE FOR TYPE CR-(XM-57)/C CRYSTAL UNITS Quarterly Report, Apr.–Jun. 1966
K. Dance Jun. 1966 23 p
(Contract DA-36-039-AMC-06182(E))
(QR-1; AD-642809) CFSTI: HC $3.00/MF $0.65

During the period the following work was performed: (1) Ordering of materials. (2) preliminary analysis of crystal designs and mounting structures, the improvement of edge finishing on the resonators, and the establishing of annealing procedures for the plated blank. (3) preparation of a PERT control system to cover the flow of the contract. TAB

N67-21463# General Electric Co., Schenectady, N. Y. Knolls Atomic Power Lab.
DYNO-1: A PROGRAM TO COMPUTE THE DISTRIBUTION OF SECONDARY ELECTRONS IN PHOTOMULTIPLIERS
J. E. Edwards and J. F. McCarthy 21 Sep. 1966 13 p ref
(Contract W-31-109-ENG-52)
(KAPL-M-6575) CFSTI: HC $3.00/MF $0.65

DYNO-1 is a FORTRAN program for calculating the distribution of electrons that are emitted from a photo-multiplier composed of a series of dynodes. The output from each dynode is assumed to have a Polya distribution. NSA

N67-21464# Radio Corp. of America, Princeton, N. J. Conversion Devices Lab.
AFTERPULSES IN PHOTOMULTIPLIERS
G. A. Morton, H. M. Smith, and R. Wasserman Oct. 1966 18 p Presented at the 13th Ann. Nucl. Sci. Symp., Boston
(Contract AT(30-1)-3421)
(NYO-3421-9; CONF-661020-11) CFSTI: HC $3.00/MF $0.65

Recently afterpulses were found in experimental photomultipliers being used in dark pulse studies. Because the phenomenon offers possible clues to some of the mechanisms in producing certain types of dark pulses, it was investigated, and the results are reported. NSA

N67-21476# California Univ., Berkeley. Lawrence Radiation Lab.
ON THE TESTING OF A SKP-1 CONTROLLABLE FAST-RESPONSE PHOTOMULTIPLIER
S. V. Muchin, H. J. Pohl, S. V. Richwizky, I. N. Semenyuskin, and I. Fotin Oct. 1966 7 p refs Transl. into ENGLISH from Nucl. Instr. Methods (Amsterdam), v. 33, 1965 p 339–340
(UCRL-TRANS-1335) CFSTI: HC $3.00/MF $0.65

The equipment for testing the SKP-1 photomultiplier is shown and described. The coincidence rate between pulses of the photomultiplier and electric pulses after their synchronization by a synchronizing device, in relation to the delay (phase shift) of the UHF control voltage is given. Also shown is the coincidence rate in relation to the delay time of the UHF control voltage of one photomultiplier as compared with the second photomultiplier. NSA

N67-21500# Sandia Corp., Albuquerque, N. Mex.
A HIGH-MEGOHM BRIDGE
D. R. Kendall and E. W. Scott Nov. 1966 24 p
(Contract AT(29-1)-789)
(SC-TM-66-558) CFSTI: HC $3.00/MF $0.65

A new bridge is described which simplifies the measurement of high-megohm resistors. The bridge uses a conventional Wheatstone circuit and is capable of measurements in the range 10^8 to 10^{14} ohms. The estimated measurement error varies from about 0.3 percent at 10^8 ohms to about 5 percent at 10^{14} ohms. The bridge simplifies two aspects of high-megohm resistor measurement which frequently cause errors: determining the voltage applied to the unknown resistance and standardizing the bridge. The use of an electrometer detector and high-megohm ratio resistors results in a bridge of high sensitivity, thus allowing resistors to be measured with low voltage applied. Author (NSA)

N67-21509# Los Alamos Scientific Lab., N. Mex.
INTENSITY MODULATION EFFECTS IN MULTIPARAMETER DISPLAYS
William W. Steger [1966] 10 p ref Presented at the 13th Ann. Nucl. Sci. Symp., Boston
(Contract W-7405-ENG-36)
(LA-DC-7988; CONF-661020-12) CFSTI: HC $3.00/MF $0.65

A number of photographs of simulated multiparameter displays are presented, showing the visual effects of several different matrix

spot intensity modulation techniques. It is shown that brightening the matrix spots in direct proportion to contents, or height contributes to the 3-dimensional illusion of isometric displays. It is also shown that brightening the matrix spots in approximate logarithmic, rather than linear proportion to contents provides improved highlighting of small picture detail, and prevents washout of picture under high ambient light viewing conditions. Conclusions are also drawn concerning the necessary CRT spot resolution for acceptable data picture quality, and minimum frame rate for flicker-free viewing. Author (NSA)

N67-21624# Iowa State Univ. of Science and Technology, Ames.
WIDE LINE NMR INDUCTION AND BRIDGE SPECTROMETER FOR THE FREQUENCY RANGE 2 TO 90 MHz
D. R. Torgeson Nov. 1966 24 p refs
(Contract W-7405-ENG-82)
(IS-1477) CFSTI: HC $3.00/MF $0.65

A wide-band, variable-frequency nuclear magnetic resonance spectrometer is described for use with either a crossed-coil induction probe in the frequency range 2 to 40 MHz or a parallel "T" rf bridge from 2 to 90 MHz. A novel use of simple rf circuits is described wherein the receiver amplifier has useful gain to 95 MHz and the transmitter amplifier has useful gain to 45 MHz. A simple modification of the Varian Associates 8–16 MHz induction probe for use with this circuit to 40 MHz is described. Sensitivity of the instrument with both the probe and bridge compares most favorably with a commercial induction spectrometer. A broad-band crystal oscillator for use with this spectrometer in the frequency range 2 to 44 MHz is presented. All the circuits are essentially free of microphonic noise. Author (NSA)

N67-21697# Erie Technological Products, Inc., Pa.
PRODUCTION ENGINEERING MEASURE FOR SUBMINIATURE FEED-THRU CERAMIC DIELECTRIC CAPACITORS Quarterly Report, 23 Jun.–23 Sep. 1966
Charles H. Lewis 23 Sep. 1966 29 p
(Contract DA-36-039-AMC-06190(E))
(QR-1; AD-643253) CFSTI: HC $3.00/MF $0.65

Progress is reported on a production engineering measure is to improve production techniques for the manufacture of subminiature feed-thru ceramic dielectric capacitors to attain a maximum failure rate of .001% per 1000 hours with a 90% confidence level when tested at 200% of rated voltage and 125C. TAB

N67-21717# University Coll., Cork (Ireland). Dept. of Electrical Engineering.
HARMONIC GENERATION AT MICROWAVE FREQUENCIES
P. T. Phelan and M. C. Sexton 1 Sep. 1966 89 p refs
(Grant AF-EOAR-65-46)
(AFOSR-67-0002; ISR-1; AD-644489) CFSTI: HC $3.00/MF $0.65

The design and performance of an experimental in-line microwave frequency harmonic generator are described and the efficiency of the Gallium Arsenide varactor diode used in this device for the generation of harmonic microwave power at 26.4 Gc/s from a fundamental frequency of 8.8 Gc/s, is discussed. The waveguide circuit includes a specially fabricated waveguide mount for the varactor and filters to extract power at the harmonic frequencies. The effect of bias voltage across the varactor on efficiency has been studied in detail, and particular attention is paid to circuit design for proper matching of the system and optimum conversion efficiencies. The experimental findings are discussed with reference to current knowledge on the subject. Author (TAB)

N67-21725# Naval Ammunition Depot, Crane, Ind.
INFORMATION ON MICROELECTRONICS FOR NAVY EQUIPMENTS
2 Jan. 1967 134 p *Its* Issue No. 18
(NAD-CRANE-QE/C-66-843; AD-644485) CFSTI: HC $3.00/MF $0.65

Information is presented on the evaluation, application, availability, research and development, and standardization activity pertaining to state-of-the-art microelectronic circuits, devices, and materials. R.N.A.

N67-21775# Atomic Energy Commission Research Establishment, Riso (Denmark). Dept. of Electronics.
AN AIR-BORNE SCINTILLOMETER
K. E. Neisig Apr. 1962 20 p
(RISO-36) CFSTI: HC $3.00/MF $0.65

A complete transistorized scintillometer designed for aerial radiometric surveys for measuring the total gamma background is described. A twin-lens 16 mm camera is used by double exposure to pick up all information of interest, such as flight-path, count-rate, and altitude. With fully loaded camera it should be possible to traverse an area corresponding to about 200 km flight-line with a 60-mile flight-speed while giving one exposure per second. Author (ESRO)

N67-21777# Eidgenossische Technische Hochschule, Zurich (Switzerland).
THE CONSTRUCTION OF A TRANSMITTER-RECEIVER FOR AN ELECTRON RESONANCE SPECTROMETER IN THE 1.25 cm BAND [BAU EINES SENDER-EMPFAENGERS FUER EIN ELEKTRONENRESONANZ-SPEKTROMETER IM 1,25 cm-BAND]
Pierre Schmid (Ph.D. Thesis) 1964 88 p refs In GERMAN
(Rept.-3574) CFSTI: HC $3.00/MF $0.65

Described is a new type of transmitter–receiver with increased sensitivity ($2 \cdot 10^{10}$ spin) and improved resolution ($1 \cdot 10^{-6}$) for an electron resonance spectrometer in the 1.25 cm band. The gain over commercially available 3 cm apparatus is based on (1) a fine-adjustable microwave bridge with high insulation (>70 dB), (2) the use of a superheterodyne receiver, and (3) the enforced phase lock between local oscillator and transmitter. The transmitter is either directly frequency stabilized on the calibration resonator or phase stabilized along a high quartz harmonic by means of an interpolation oscillator. The quartz harmonic serves in both cases as reference for exact g-factor measurements with a frequency counter. Discussed in addition to the experimental arrangement are theories of the microwave bridge, the various klystron control circuits, and the phase-sensitive intermediate-frequency demodulation. Transl. by K.W.

N67-21783# Oak Ridge National Lab., Tenn.
NEW APPROACH TO DIRECT CURRENT INTEGRATION
F. M. Glass, C. C. Courtney, E. J. Kennedy, and H. N. Wilson [1964] 10 p refs Presented at the 13th Ann. Nucl. Sci. Symp., Boston
(Contract W-7405-ENG-26)
(ORNL-P-2639; CONF-661020-7) CFSTI: HC $3.00/MF $0.65

A new all-solid state direct-current integrator integrates currents as low as 10^{-11} ampere with an accuracy of 1%. The operating principle is similar to that of more conventional current integrators in that the voltage across a storage capacitor in the input circuit is monitored by an electrometer type operational amplifier, the output of which triggers a discriminator at a given voltage level. The discriminator generates a reset pulse which removes a fixed charge from the integrating capacitor. This is where the similarity ends. The diode pump circuit, which has long been recognized as an ideal circuit for removing precise quantities of charge from the integrating capacitor, has been replaced by complementary silicon planar transistors that operate in the inverted-mode and serve as current switches. These transistors normally have both their base-emitter and base-collector junctions

reverse biased and look like open switches with leakage currents of about 10^{-13} ampere. Reset pulses switch these transistors from the reverse-biased state to the active state for a precise time during which a constant current flows to or from the integrating capacitor. Therefore, each reset pulse removes from the integrating capacitor a precise charge that is the product of the current and the period of the active state. By the employment of sufficient gain in the operational amplifier to maintain small voltage excursions at the input, the total effective leakage may be kept as low as 10^{-14} ampere. A scaler output provides an indication of the integrated charge, and a built-in duty cycle meter calibrated in counts per second provides an indication of the instantaneous current. Author (NSA)

N67-21836# Army Electronics Labs., Fort Monmouth, N. J.
ELECTRON BEAM ANALYZER FOR TESTING LINEAR BEAM MICROWAVE DEVICES
Charles M. De Santis Oct. 1966 20 p refs
(ECOM-2767; AD-642922) CFSTI: HC $3.00/MF $0.65

A beam analyzer is discussed which was constructed for the investigation of characteristics of electron beams employed in linear beam microwave tubes. The design and construction features of the four basic parts of the analyzer are described in detail. Experimental results, which were obtained on two electron guns of simple geometry, are presented and used to evaluate the operation of the analyzer. The problem areas involving ion production due to poor vacuum in the analyzer are also discussed. Author (TAB)

N67-21859# Army Electronics Labs., Fort Monmouth, N. J.
HIGH-CURRENT ZENER-DIODE-ARRAY VOLTAGE TRANSIENT SUPPRESSOR
Bernard Reich Nov. 1966 17 p
(ECOM-2777; AD-645255) CFSTI: HC $3.00/MF $0.65

A high-current zener diode array applied as a voltage transient suppressor is demonstrated. The advantage of this type of device over series line regulating devices such as the linear series regulator, chopper type regulator, and the voltage cut-off device is described. The zener diode when applied as a transient suppressor offers simplicity in circuit design, absence of line insertion loss, and minimum power dissipation in the non-transient operating conditions. Author (TAB)

N67-21860# Radio Corp. of America, Somerville, N. J.
THIN-FILM POLYCRYSTALLINE FIELD-EFFECT TRIODE Quarterly Report, 1 Jul.–30 Sep. 1966
M. L. Topfer, J. J. Fabula, A. K. Rapp, and R. L. Schelhorn Dec. 1966 29 p
(Contract DA-28-043-AMC-02432(E))
(ECOM-02432-1; QR-1; Rept.-1; AD-645262) CFSTI: HC $3.00/MF $0.65

Life test data are presented on thin-film transistors which have been on load life test for over 2,000 hours. Some of the problems associated with the masking technique used to fabricate the four-input NOR/OR gate circuit are discussed. Testing procedures to be used to evaluate the circuit are discussed in detail. Some of the test data on the initial circuits fabricated are presented. Author (TAB)

10 ELECTRONICS

Includes circuit theory; and feedback and control theory. For applications see: 09 Electronic Equipment. For related information see: Specific Physics Categories.

N67-20578# Naval Medical Research Inst., Bethesda, Md.
THE EFFECTS OF SOCIAL ISOLATION AND GROUP COMPOSITION ON PERFORMANCE
Irwin Altman and William W. Haythron [1966] 61 p refs
(AD-642599) CFSTI: HC $3.00/MF $0.65

The study examined performance of socially isolated and nonisolated dyads on two group tasks and on an individual task. Dyads were formed according to a Greco-Latin square design with composition differences on dogmatism, need achievement, need affiliation and need dominance. Nine dyads lived in a small room for ten days with no outside contact. Matched controls followed the same schedule but had access to other people and outside facilities. Results on group tasks indicated that isolated dyads outperformed control dyads and that incompatible pairs tended to do better than compatible ones (primarily in control groups). In isolation, hypothetically compatible compositions generally performed as well or better than their matched controls, whereas incompatible dyads performed the same or slightly worse than their control counterparts. By integrating these data with stress and symptomatology findings, the results were accounted for within an inverted U-shaped performance-stress function. Single sources of mild stress (either isolation or composition) were associated with enhanced performance; combined composition and situational stresses led to a lessening of performance effectiveness. Author (TAB)

N67-20669# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ON THE APPLICATION OF SHOCK TUBES FOR INVESTIGATION OF CHEMICAL REACTIONS
A. A. Borisov, S. M. Kogarko, and A. V. Lyubimov 15 Aug. 1966 22 p refs Transl. into ENGLISH from Zh. Prik. Mekhan i Techn. Fiz. (Moscow), no. 3, 1960 p 175–183
(FTD-MT-65-257; TT-67-60274; AD-643982) CFSTI: HC $3.00/MF $0.65

An investigation was made of the motion of shock waves in inert (Ar, N2) and reacting gases (97% Ar + 3% (11/12 O2 + 1/12 C7H16) in a shock tube. It is experimentally shown that real flow of nonreacting gas in shock tube strongly differs from that obtained from theory. Experiments with reacting mixtures showed that investigation of kinetics of exothermic reactions in shock tubes is complicated by disturbance of uniformity of flow of gas and deviation of parameters of flow from values calculated theoretically. Delays of ignition of this mixture in region of temperatures 1500-2400K and pressures 3-20 atm are determined. Author (TAB)

N67-20673# Aeronutronic, Newport Beach, Calif.
MULTI-LAYER ADAPTIVE NETWORKS
Roger A. Stafford 1 Nov. 1966 48 p
(Contract Nonr-2913(00))
(U-3813; AD-643173) CFSTI: HC $3.00/MF $0.65

The report is concerned with logic networks whose logical properties are adaptable in response to error signals relating to the networks performance. That is, a device is envisioned which receives inputs, possesses certain variable internal parameters, and produces outputs which depend on both the inputs and the internal parameters. If these outputs are not those desired, error indications to the device should cause such a change in the devicess internal parameters as will properly correct these outputs. If such a device is composed of a network of the variable-weight threshold elements described below, their weights being the required internal parameters, then the device will be called a learning network. Learning networks are of considerable importance because of the possibilities they offer for producing networks whose logical properties as given by their weight values are too complex to have been devised by hand. That is, it may transcend the capabilities of a human logical designer to arrive at the logic required to sort

out, say, the various letters in hand-written cursive writing where this constitutes the input to a network. Learning networks could also have importance in real time situations where some form of rapid and complex adaptation is required which is beyond the capabilities of the more orthodox methods. Because of the great difficulties involved, no attempt is made in this report at an analysis of these networks and their properties. It is solely an empirical investigation of them based on computer-simulated experiments.
Author (TAB)

N67-20694# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THEORY OF LINEAR PULSE SYSTEMS
Ya. Z. Tsypkin 27 Jun. 1966 1041 p refs Transl. into ENGLISH of the book "Teoriya Lineynykh Impul'snykh Sistem" Moscow, Gos. Izd. Fiz.-Mat. Lit., 1963 p 1–968
(FTD-MT-64-133; TT-67-60324; AD-644108) CFSTI: HC $3.00/MF $0.65

Contents: Pulse systems and their application; Bases of discrete Laplace transformations; Theory of open pulse systems; Investigation and calculation of open pulse systems; Theory of closed pulse systems; and Investigation and calculation of closed systems.
TAB

N67-21150 Royal Aircraft Establishment, Farnborough (England).
THE THEORY OF SYNCHRONOUS MACHINES UNDER VARIABLE OPERATING CONDITIONS WITH EXAMPLES OF APPLICATIONS AND WITH REFERENCE TO THE MODERN AMERICAN LITERATURE [DIE THEORIE DER SYNCHRONMASCHINE IM NICHTSTATIONAEREN BETRIEB MIT ANWENDUNGSBEISPIELEN UND UNTER BERUECKSICHTIGUNG DER MODERNEN AMERIKANISCHEN LITERATUR]
Th. Laible Nov. 1965 166 p refs Transl. into ENGLISH from the book "Maschinenfabrik Oerlikon" Zurich, 1952 p 1–128
(RAE-LIB-TRANS-1130) CFSTI: $3.00

The general theory of the transient behavior of synchronous electrical machines in terms of the Laplace transformation, without using matrix methods, was derived from first principles. The general theory is presented, and attention is given to fundamental principles, dimensionless ratios, the relationships between phase dimensions and axis dimensions, and the complete equational system for transient processes. Consideration is also given to the application of the theory to special cases, including the synchronous machine in asynchronous operation, small oscillations of the synchronous machine, and short circuit procedures. Mention is also made of the derivation of the torque from the rating, and the modified Laplace transformation.
L.E.W.

N67-21170 Joint Publications Research Service, Washington, D. C.
INDUSTRIAL APPLICATION OF AUTOMATIC CONTROL SYSTEMS AND COMPUTERS
V. A. Grubov, A. G. Ivakhnenko, and B. Yu. Mandrovskiy-Sokolov 15 Feb. 1967 85 p Transl. into ENGLISH of the book "Promyshlennaya Kibernetika" Kiev, Naukova Dumka, 1966 p 110–174
(JPRS-39918; TT-67-30566) CFSTI: HC $3.00

Automatic machines, computers, and systems employed in controlling and monitoring in industrial processing facilities are reviewed. Several specific systems in operation in metallurgical and chemical engineering plants are described. Details are presented on the design of control computers, centralized monitoring devices, and on specialized monitoring digital and analog computers.
N.E.N.

N67-21201# Royal Aircraft Establishment, Farnborough (England).
APPROXIMATION OF THE TRANSFER CHARACTERISTIC OF THE PARALLEL-T RC NETWORK
Minoru Higashiguchi Nov. 1966 21 p refs Transl. into ENGLISH from J. Inst. Elec. Commun. Engr. Japan (Tokyo), v. 40, 1957 p 541–546
(RAE-LIB-TRANS-1193) CFSTI: HC $3.00/MF $0.65

It was found that the transfer characteristic of the parallel-T single-frequency rejecting RC network can be approximated as a circle even where there is a slight deviation from null conditions. The position and diameter of the circle, together with the speed of rotation of the vector for the frequency variation were calculated, thus making clear the effects of various circuit elements on the transfer characteristic. It will be explained on the basis of these results that a factor, λ, which is the difference between a capacitance ratio and resistance ratio of the network components, is an important factor controlling the transfer characteristic. It was found from further investigations relating to the control of a selective amplifier that the simple control of centre frequency and selectivity, almost independent of each other, is possible by using suitable circuit constants.
Author

N67-21385# Illinois Univ., Urbana. Coordinated Science Lab.
TRANSFORMATION FOR NETWORK ANALYSIS
Wataru Mayeda Nov. 1966 28 p refs
(Contract DA-28-043-AMC-00073(E); Grant AF-AFOSR-931-66)
(R-329; AD-644518) CFSTI: HC $3.00/MF $0.65

Since a computer is used to analyze a network, many new methods of analysis are introduced. Obviously, these have many advantages, however, all of these methods suffer from the exponential increase of computer time as networks become larger. It is clear that a simplification of a given network is a solution to this difficulty. A simple transformation introduced here give an equivalent network with respect to a desired network function which has less number of vertices, thus, in general, the computation becomes simpler. A special case of this transformation is a well known T–Pi transformation. The successive application of this transformation can be employed to reduce the number of vertices so that the final resultant network has the minimum number of vertices necessary to give the desired network functions. This procedure is very similar to successive reduction of vertices (nodes) in a signal flow graph.
Author (TAB)

N67-21473# Comitato Nazionale per l'Energia Nucleare, Rome (Italy).
INTRODUCTION TO INVESTIGATION OF ADAPTIVE LOGIC ELEMENTS [INTRODUZIONE ALLO STUDIO DEGLI ELEMENTI A SOGLIA ADATTIVI]
M. Arabia, S. Colussi, G. V. Pallottino, and A. Sano 1966 26 p refs In ITALIAN
(RT/EL/66/-6)

The working principles of adaptive logic systems are described in view of their applications in nuclear instrumentation and nuclear process control. The basic problems are stated which are pertinent to the synthesis of adaptive logic networks and their practical realization. With regard to that a comparison is made among the various adaptive components already existing and a new one which is under study.
Author (NSA)

N67-21844# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ONE TYPE OF PROBABILITY DISCRETE AUTOMATA
V. N. Roginskiy 5 Dec. 1966 14 p refs Transl. into ENGLISH from Akad. Nauk SSSR, Lab. Sistem Peredachi Informatsii, Probl. Peredachi Informatsii, No. 17, 1964 p 85–90
(FTD-HT-66-646; TT-67-60680; AD-646287) CFSTI: HC $3.00/MF $0.65

In the development of control systems the problem of producing one or another signal with a certain given probability

realizing different sequences of internal states with identical sequences of input signals is encountered with a certain given probability. Such systems are called discrete automata (PDA). This report examines some of them as a (p, k)-pole with control inputs and outputs. The input and output signals are two-valued (0 and 1). Certain designations are given for various values. The problem of synthesizing single-cycle discrete automata is formulated. Binary probability functions are introduced. Various diagrams are shown. The single-cycle probability is mentioned. Many equations are given. Author (TAB)

11 FACILITIES, RESEARCH AND SUPPORT

Includes airports; lunar and planetary bases including associated vehicles; ground support systems; related logistics; simulators; test facilities (e.g., rocket engine test stands, shock tubes, and wind tunnels); test ranges; and tracking stations.

N67-20407*# Brown Engineering Co., Inc., Huntsville, Ala. Scientific Research Labs.
AN EVALUATION OF POTENTIAL LOCATIONS FOR AROD GROUND STATIONS
H. C. Crews, Jr., H. M. Minshew, and J. E. White, Jr. Oct. 1963 50 p refs Revised
(Contract NAS8-2495)
(NASA-CR-83051; R-34) CFSTI: HC $3.00/MF $0.65 CSCL 17B

CONTENTS:
1. INTRODUCTION 28 p refs (See N67-20408 10-11)
2. ACCURACY OF THE AROD SYSTEM IN THE EARLY MINUTES OF FLIGHT R. Holmes 50 p (See N67-20409 10-11)

N67-20408*# Brown Engineering Co., Inc., Huntsville, Ala. Scientific Research Labs.
INTRODUCTION
In its An Evaluation of Potential Locations for AROD Ground Sta. Oct. 1963 28 p refs (See N67-20407 10-11) CFSTI: HC $3.00/MF $0.65

The available Airborne Range and Orbit Determination ground stations are evaluated in terms of minimum geometric dilution of precision for typical Saturn trajectories on a bearing angle of 105° from true North. Coordinates of typical stations in each area are evaluated in terms of a minimum elevation angle (5°) for each trajectory position. This determines which stations can establish line-of-sight communications with the vehicle for each trajectory position. All combinations of such stations are taken three at a time and root-mean-square error volumes are calculated. The groups are arranged in order of least error volume. The group consistent with continuous tracking having the least error is selected. The logical choices are the Bermuda, Antigua, Cape Canaveral, and Jupiter stations. If early track is desired, the fifth station should be San Salvador. If burnout and separation must be tracked, then the fifth station must be Grand Turk. R.N.A.

N67-20409*# Brown Engineering Co., Inc., Huntsville, Ala. Scientific Research Labs.
ACCURACY OF THE AROD SYSTEM IN THE EARLY MINUTES OF FLIGHT
R. B. Holmes 30 Sep. 1963 *In its* Evaluation of Potential Locations for AROD Ground Sta. Oct. 1963 50 p (See N67-20407 10-11) CFSTI: HC $3.00/MF $0.65

To demonstrate the accuracy of the AROD tracking system in the early minutes of flight, error calculations were made for close-in trajectory points along a launch trajectory with initial bearing angle of 105°. For these calculations, points were chosen along the trajectory at 20 sec intervals from time equal to 157 sec through 397 sec. Combinations of 11 ground-based tracking stations that can cover the early part of the trajectory were used. After calculating each point for all combinations of stations taken three at a time, the radius of the equivalent spherical error volume for position was used to compare the results. For each trajectory point the ten best combinations of stations were listed in the order of their equivalent radius. From the initial point to time equal to 257 sec, the combination of stations that give the best overall coverage is Cape Canaveral, Grand Bahama, Page Field. At time equal to 277 sec, Andros Central, New Smyrna Beach, San Salvador become the best choice for the rest of the points. If New Smyrna and Page Field are to be used, additional antennas must be mounted on the missile, since they are outside the wave pattern for an antenna mounted to point down range with half-angle of 70°. Author

N67-20456# White Sands Missile Range, N. Mex. Atmospheric Sciences Lab.
MUZZLE VELOCITY MEASUREMENT
Bruce Kennedy Oct. 1966 26 p refs
(ECOM-5083; AD-642859) CFSTI: HC $3.00/MF $0.65

Methods currently used to measure muzzle velocity of tube-launched meteorological probes are described in detail. The methods are categorized as the make-switch and the break-switch systems. Accuracy considerations applicable to both systems are discussed. Application of the measurement system to Loki, Arcas, and gun probe vehicles is discussed. Author (TAB)

N67-20518*# Colorado State Univ., Fort Collins. Coll. of Engineering.
FACILITIES AND EXPERIMENTAL EQUIPMENT
V. A. Sandborn, James P. Rybak, and R. L. Moore *In its* Advanced Elec. Propulsion Res. Jan. 1967 8 p refs (See N67-20509 10-28) CFSTI: HC $3.00/MF $0.65

Continuing improvements and additions to the facilities and equipment are reported. The vacuum system was modified to allow thrustor operation at potential differences up to 300,000 volts. A small surplus liquid nitrogen plant was installed. A feasibility study of aluminum colloid particles by homogeneous condensation is emphasized. The ionization chamber design for charging the colloid particles by electron bombardment is briefly described. The construction of a quadrupole mass filter to be used in the analysis of the beam produced by the colloid thrustor is mentioned. N.E.N.

N67-20530# MSA Research Corp., Evans City, Pa.
DEVELOPMENT OF A CARBON HEATING UNIT Final Report, Jun. 1963–Aug. 1965
Miles J. McGoff and Walter Milich Natick, Mass., Army Natick Labs., Jul. 1966 62 p
(Contract DA-19-129-AMC-105(N))
(TR-67-13-CM; MR&E-66-3; AD-642930) CFSTI: HC $3.00/MF $0.65

Experimental carbon heating units to boil water for reconstituting precooked dehydrated foods were developed at the U. S. Army Natick Laboratories and produced in contractors pilot plant for field and laboratory study. These were designated as

Phase I units. As a result of further experimentation, and based on the test findings, the contractor produced an improved unit that was designated as Phase II. Both units consisted of carbon fuel, igniter, stove support, base reflector, and shield or chimney. The Phase I fuel was a charcoal slab with perforations. The reflector was of rigid aluminum. At an ambient temperature of 68F, this unit boiled 6 quarts of water in 10 minutes and, at an ambient temperature of 46F, thawed snow or ice and boiled the resultant water in 22 minutes. In Phase II, several types of fuel were developed, the most promising of which was made from commercially available char fuel briquettes broken into approximately 1-inch pieces. Inexpensive fiberboard and aluminum foil replaced the rigid aluminum as reflector and the stove support was made of 4 simple parts. Under the same ambient conditions, these units brought 6 quarts of water to a boil in 14 minutes and thawed snow or ice and boiled the resultant water in 30 minutes. Author (TAB)

N67-20555# Ballistic Research Labs., Aberdeen Proving Ground, Md.

FEASIBILITY OF LAUNCHING MICRON-SIZE PARTICLES AT SPEEDS OF 12,000 FT/SEC TO 18,000 FT/SEC

Walter F. Braun Sep. 1966 38 p refs

(BRL-MR-1780; AD-643537) CFSTI: HC $3.00/MF $0.65

A technique is described whereby a light gas gun was used to launch micron-size spherical particles of the stable isotope of a radioactive salt at velocities up to 18,000 ft/sec. The required sabot was successively retarded, deflected and stopped before reaching the range area. Spark shadowgraph and streak camera techniques were used to observe the particles in free flight. Author (TAB)

N67-20657# Frankford Arsenal, Philadelphia, Pa. Small Caliber Engineering Directorate.

AN INTERIOR BALLISTIC ANALYSIS OF A HIGH-LOW PRESSURE GUN USING NOZZLE-START, SHOT-START AND SECONDARY IGNITER MATERIAL Final Report

Sidney Goldstein and A. Leibowitz May 1966 27 p refs

(R-1813; AD-637152) CFSTI: HC $3.00/MF $0.65

Interior ballistic equations suitable for computer analysis are developed to predict the performance of the 40MM grenade launcher M79 firing the multiple projectile cartridge XM576. These equations take into account the effects of the nozzle-start and shot-start pressures which are characteristic of this system. Also considered is the effect of secondary igniter material upon the ballistic performance. An isothermal model is used for the period during which the propellant is burning. Only propellant of constant burning surface area is considered. Author (TAB)

N67-20682# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

TARTU STATION FOR OBSERVING ARTIFICIAL EARTH SATELLITES

M. K. Liygant 14 Jul. 1966 6 p Transl. into ENGLISH from Byul. St. Optich. Nablyudeniya Iskusstv. Sputnikov Zemli (USSR), no. 33, 1963 p 26-29

(FTD-HT-66-321; TT-67-60301; AD-644014) CFSTI: HC $3.00/MF $0.65

Film type DK. Negative measurements carried out on an UIM-21. Treatment was carried out by the Kiselev method. Calculations on the Ural computer carried out by A. Koryus and Kh. Khaki. Times given in standard time. Correction for radial apparatus. No correction was made for refraction. TAB

N67-20705# Ballistic Research Labs., Aberdeen Proving Ground, Md.

THE ELECTROMAGNETIC PROPAGATION RANGE FACILITY AT THE BALLISTIC RESEARCH LABORATORIES

Channing L. Adams Jul. 1966 86 p

(BRL-R-1331; AD-643770) CFSTI: HC $3.00/MF $0.65

The report describes the instrumented range facility designated the electromagnetic propagation range as established by the Ballistic Research Laboratories (BRL) in support of fundamental research in the near-earth meteorological environment. It includes a description of the multi-channel, high-speed, digital data acquisition system, the types of instrumentation used for obtaining meteorological data, methods of instrument and sensor calibration, and typical results of field programs. Tabulated data and photographs of all parts of the system are included. Author (TAB)

N67-20714# Curtiss-Wright Corp., Caldwell, N. J.

CWEA-3 MULTI-ENGINE ANALYZER Final Report

C. J. Zabriskie and R. G. Locklin 30 Nov. 1966 101 p refs

(Contract NOw-65-0094-f)

(C-3003; AD-643938) CFSTI: HC $3.00/MF $0.65

The purpose of the work was to (1) conduct a field evaluation of the CWEA-2 interim sonic engine analyzer, (2) perform a research and development program to obtain acoustical field test data on J79 engines, and (3) design and fabricate a multi-engine sonic analyzer. The following conclusions are derived: (1) The performance record of the CWEA-2 analyzer during the evaluation testing and subsequent continued use has established a high degree of confidence in its reliability as a valuable maintenance tool. (2) The results of the data obtained from the J79 component change program were useful in establishing engine component condition limits for the CWEA-3 analyzer. However, the cost and time consumed in conducting a component change program is not worth the effort inasmuch as better results can be obtained during a field evaluation of the analyzer. (3) A study of the CWEA-2 analyzer circuitry, and the portability, maintainability and power requirements for an improved analyzer design resulted in a complete redesign of the CWEA-2 analyzer which was incorporated into the resulting CWEA-3 analyzer. TAB

N67-20738# Rochester Univ., N. Y. Dept. of Physics and Astronomy.

DESIGN STUDY FOR MUON AND ANTIPROTON FACILITY AT SLAC

F. Lobkowicz, D. Green, and S. Serio 10 Aug. 1966 81 p refs

(Contract AT(30-1)-875)

(UR-875-161) CFSTI: HC $3.00/MF $0.65

The design feasibility of a storage ring at the SLAC facility is considered. This storage ring is for trapping antiprotons and mesons (μ). A general description of the storage ring, its use as a meson (μ) and antiproton facilities, and the reason for the selection of SLAC are discussed. It is believed that the feasibility of the project is definitely demonstrated and that the region of reasonable parameters is found. NSA

N67-20763# Los Alamos Scientific Lab., N. Mex.

OPERATING CHARACTERISTICS OF A FULL POWER CLOVERLEAF ACCELERATOR TANK

D. R. Copenhagen, E. A. Knapp, and J. M. Potter 16 Sep. 1966 13 p refs Presented at the Linear Accelerator Conf., Los Alamos, N. Mex.

(Contract W-7405-ENG-36)

(LA-DC-8249; CONF-661021-3) CFSTI: HC $3.00/MF $0.65

An 805 MHz, forty-one cell cloverleaf accelerator tank was fabricated and evaluated. The operating parameters as well as the tuning procedures and problems associated with this particular model are discussed. Results from both low and high power tests are included. Author (NSA)

N67-20788# California Univ., Berkeley. Lawrence Radiation Lab.
TWO-HUNDRED BeV ACCELERATOR: STUDIES ON EXPERIMENTAL USE, 1964–1965. VOLUME II: EXPERIMENTAL EQUIPMENT, TARGETING, EXPERIMENTAL AREAS, AND FACILITIES
D. Keefe et al Apr. 1966 317 p refs
(Contract W-7405-ENG-48)
(UCRL-16830, Vol. II; UCID-10184, Vol. II) CFSTI: HC $3.00/MF $0.65

A collection of reports (UCID and UCRL Series) is presented which is connected mainly with the experimental use of the 200 GeV accelerator. The reports are grouped into two broad categories: experimental equipment and targeting, experimental areas, and facilities. NSA

N67-20791# California Univ., Berkeley. Lawrence Radiation Lab.
HIGH-DUTY-FACTOR CONVERSION OF THE BERKELEY HILAC
Bob H. Smith 19 Sep. 1966 9 p Presented at the 1966 Linear Accelerator Conf., Los Alamos, N. Mex., 3–7 Oct. 1966
(Contract W-7405-ENG-48)
(UCRL-17111; CONF-661021-22) CFSTI: HC $3.00/MF $0.65

A 6-MW dc power supply and a hard-tube modulator system was installed at the Hilac to supply the anode power for the oscillators of the two linear accelerators. The pulse repetition rate and pulse width are variable. Most bombardments use a repetition rate of 40 pulses per second and pulse widths between 2 and 8 msec. The rf system and ion-source equipment were modified to handle the increased average power. Additional water cooling was applied to the linac tanks. The coupling line between the two tanks was removed and an electronic phase regulating system was installed. Improved rf amplitude regulators were developed and installed. Another RCA type-6949 tube was added to the poststripper tank. The rf system now consists of five type-6949 tubes, four of which are self-excited oscillators and one a driven amplifier. The latter serves as a pre-exciter and also keeps the self-excited oscillators on the correct tank mode. The prestripper is excited by an RCA-6949 in a drive amplifier circuit. Author (NSA)

N67-20811# California Univ., Berkeley. Lawrence Radiation Lab.
MEASUREMENTS ON A MODEL RF MANIFOLD SYSTEM
Ferdinand Voelker 16 Sep. 1966 18 p refs Presented at the Linear Accelerator Conf., Los Alamos, N. Mex., 3–7 Oct. 1966
(Contract W-7405-ENG-48)
(UCRL-17130; CONF-661021-23) CFSTI: HC $3.00/MF $0.65

A one-tenth-scale rf manifold system with six cavity loads and several amplifiers operating at 200 MHz was set up. The manifold is a 50-ft-long coaxial line, and the cavities are foreshortened quarter-wave resonators with about 25 higher-order resonances below 2GHz. The measurement program consists of three parts. The first part consists of steady-state measurements of amplitude and phase along the system in the principal pass band. The second part consists of measurements during the rise and fall time in pulsed operation. The third part consists of measurement of higher-order modes of the system which are excited by very short pulses of current (~0.25 nsec) in the gaps of the cavities. Author (NSA)

N67-20820# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
APPLICATION OF SAFEGUARDS TO NUCLEAR FUEL PROCESSING PLANTS
D. P. Granquist and R. A. Schneider Sep. 1966 52 p refs
(Contract AT(45-1)-1830)
(BNWL-301) CFSTI: HC $3.00/MF $0.65

Safeguard procedures developed for chemical processing plants operating with a Purex-type flowsheet are discussed. It was assumed that safeguards start with receipt of irradiated fuel at the separations plant and end when the material is shipped from the site. The study of instruments and hardware necessary to provide adequate safeguards was purposely limited to available equipment and did not include the laboratory development of special apparatus. It is believed that such apparatus could be developed with further work. The topics covered include: philosophy of control; safeguards problems in typical plant operation; inspection procedures; measurement and accounting procedures; and effectiveness of material balance control. NSA

N67-20861# California Univ., Livermore. Lawrence Radiation Lab.
A REPLACEMENT THYRATRON FOR THE ASTRON ACCELERATOR
James H. Cooper 23 Sep. 1966 10 p Presented at Symp. on Eng. Probl. of Controlled Thermonucl. Res., Gatlinburg, Tenn., 3–6 Oct. 1966
(Contract W-7405-ENG-48)
(UCRL-70015; CONF-661016-4) CFSTI: HC $3.00/MF $0.65

A test set was constructed to reproduce accelerator characteristics with a variable 32-kv resonant charge power supply, pulse amplifiers, a prefire detector and a 1-nsec time delay counter. The thyratrons were tested at a 1440 pulses per second pulse ratio, 0.4 μsec long, with bursts of pulses up to 100 pulses per burst, and 2 seconds per burst. Anode delay stability was tested by recording delay time from grid pulse to load pulse while the operating conditions were changed from 32 kv, 10 ppb to 32 kv, 100 ppb to 25 kv, 10 ppb and back to 32 kv, 10 ppb. The pulse forming network had a characteristic impedance of 7 ohms and resistive loads of 6.2 and 8.3 ohms were used. Anode delay as a function of heater voltage was also tested. The tests indicated reliable operation at 32 kv without preconditioning an average anode delay of 143.8 nsec, and average drift of anode delay of 14 nsec, an average anode delay variation of 33.5 nsec with a rise time of less than 50 nsec for a group to ten tubes tested. A full set of these deuterium tetrode thyratrons installed would greatly enhance the operation of the ASTRON accelerator. Author (NSA)

N67-20865# Cambridge Electron Accelerator, Mass.
STORAGE RING FOR OBTAINING SYNCHROTRON RADIATION WITH LINE SPECTRA
Kenneth W. Robinson 19 Sep. 1966 12 p
(Contract AT(30-1)-2076)
(CEAL-1032) CFSTI: HC $3.00/MF $0.65

It appears possible to design a very small electron storage ring in which line spectra in the optical synchrotron radiation could be obtained. These lines would be related to harmonics of the orbital frequency. This device could be used to measure the velocity of light to very high accuracy. Also the lines would be very coherent light sources for experiments on photon statistics. The effects of betatron and synchrotron oscillations, due to gas scattering and quantum effects, on the spectrum of optical synchrotron radiation are analyzed, and the results applied to a possible design of the ring. Author (NSA)

N67-20879# California Univ., Berkeley. Lawrence Radiation Lab.
STATUS AND FUTURE PLANS FOR LRL FLYING SPOT DIGITIZER
Howard S. White Sep. 1966 11 p refs Presented at the Intern. Conf. on Instrumentation for High Energy Phys., Stanford, Calif., 9–10 Sep. 1966
(Contract W-7405-ENG-48)
(UCRL-17114; CONF-660918-5) CFSTI: HC $3.00/MF $0.65

The operation of the Berkeley flying spot digitizer during the past three years is summarized. NSA

N67-20880# California Univ., Livermore. Lawrence Radiation Lab.
MERCURY-JET SWITCH
D. R. Branum and G. G. North 23 Sep. 1966 17 p Presented at the Symp. on Eng. Probl. of Controlled Thermonucl. Res., Gatlinburg, Tenn., 3–6 Oct. 1966 Submitted for publication
(Contract W-7405-ENG-48)
(UCRL-70014; CONF-661016-3) CFSTI: HC$3.00/MF$0.65

To meet the high-current, long-duration series switching requirements of the electrolytic capacitor banks used with the Levitron experiment, development was begun on a fast mechanical switch using a mercury-jet as contact medium. The prototype switch is air-operated, with the mercury being stored in 2-in. i.d. stainless steel bellows. By abruptly applying air pressure to the outside of the bellows, the mercury is ejected from the bottom electrode through a 1-cm diameter orifice toward the top electrode. The electrodes are enclosed by a pyrex glass section which is evacuated. Initial load tests on the switch were made with a capacitor bank-coil combination capable of giving an 8000-A peak current with a 1/4-cycle rise time of 11 msec, and a 25-msec L/R decay. In tests, the switch has operated up to the available peak of 8000 A repeatedly and gives every indication of being able to greatly exceed this figure, as inferred by the nominal 8-v drop across the switch at 8000 A. The closing time of the switch for these tests was 20 ± 0.2 msec. Author (NSA)

N67-20945# Oak Ridge National Lab., Tenn.
THE 4-MeV EXPERIMENTAL SOC—DESIGN DETAILS
E. D. Hudson, J. E. Mann, J. A. Martin, F. E. McDaniel, S. W. Mosko et al [1966] 18 p Presented at the Symp. on Separated Orbit Cyclotrons and Beam-Cavity Interactions, Weston-on-the-Green, Engl., 6–8 Jul. 1966 Submitted for publication
(Contract W-7405-26)
(ORNL-P-2358; CONF-660720-2) CFSTI: HC$3.00/MF$0.65

The novel design features of the 4-MeV SOC multi-energy, multi-particle accelerator are discussed. Topics include the magnet system, r–f system, and the injector. NSA

N67-20958# Brookhaven National Lab., Upton, N. Y.
LINACS OF THE FUTURE
J. P. Blewett [1966] 3 p Presented at Linear Accelerator Conf., Los Alamos, N. Mex.
(Contract AT(30-2)-GEN-16)
(BNL-10687; CONF-661021-12) CFSTI: HC$3.00/MF$0.65

Recent developments of the linac are reviewed, and specific plans for new injectors for large proton synchrotrons in increasing order of synchrotron energy are discussed. The future development of linacs is also considered. The major advance is thought to be cryogenic linacs, which except for rf structure, can yield continuous beams. A few speculative ideas are also mentioned. NSA

N67-20982# California Univ., Livermore. Lawrence Radiation Lab.
LIQUID HELIUM CRYOPUMPS FOR A LARGE PLASMA RESEARCH MACHINE
Balwant S. Denhoy 23 Sep. 1966 17 p refs Presented at the Symp. on Eng. Probl. of Controlled Thermonucl. Res., Gatlinburg, Tenn., 3–6 Oct. 1966 Submitted for publication
(Contract W-7405-ENG-48)
(UCRL-70024; CONF-661016-5) CFSTI: HC$3.00/MF$0.65

The liquid He cryopumps discussed here are designed to meet specific requirements for hydrogen pumping in the 10^{-12} torr range. They are designed to have about a 2000 liters/sec pumping speed. The design meets configuration and space requirements, and also has the required pumping surface. All stainless steel construction is used to avoid magnetic coupling. Complicated mechanical supports are used to minimize the heat loss. In one pump a physical property of liquid helium (low viscosity) is utilized to solve the configuration problem. A model of such a pump was made to study this phenomenon. The test results of the model are presented. Author (NSA)

N67-21141# European Atomic Energy Community, Ispra (Italy). Joint Nuclear Research Center.
LOW ENERGY HIGH PERVEANCE ELECTRON GUN
G. Bressanin and G. Hodapp Brussels, Dec. 1966 39 p refs
(EUR-3255.e) CFSTI: HC$3.00/MF$0.65

A low energy electron gun with good focusing properties has been developed. The gun can work in the following conditions: energy of the electrons at the target, 80 eV; diameter of the beam, 1 mm^2; and current density of the beam, .2 mA/cm^2. The device consists of a Pierce-type gun and a decelerating and focusing structure. The plane electrodes were calculated with the paraxial ray equation. A description of the techniques employed for the construction has been given. Author

N67-21149 Central Lab. TNO, Delft (Netherlands).
DEVELOPMENT OF AN ION BLOWER [ENTWICKLUNG EINES IONENBLAESERS] Final Report
P. Platzek Brussels, EURATOM, Dec. 1966 33 p refs *In* DUTCH; ENGLISH summary
(Contract EURATOM-002-61-12 IRAN)
(EUR-3177.d)

The experiments led to a better quantitative understanding of the influence which the independently variable parameters of a blower design have on the ion current attainable at the blower outlet. An actual case was also used to illustrate that a simple experimental blower, if suitably designed, could neutralize the continuously induced charge. The following conclusions were drawn: (1) Formulas can be drawn up which correlate the magnitude of the bipolar ion current with the amount of radioactivity used, the air velocity and the equipment dimensions. (2) The relations derived were successfully tested, in particular, at the high air velocities at which the more interesting ion currents are obtained. (3) It was found that the diameter of the chamber in which the radioactive ion exciter is mounted plays an important part. (4) The maximum ion currents obtained amounted to $8–9.10^{-9}$ amps. (5) With 100 mc Kr-85 an ion current of 10^{-7}amps ought to be obtained in an ion chamber 10 cm in diameter for an air flow of 50 l/sec. Author

N67-21179*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
AN IMPROVED SULFUR HEXAFLUORIDE GAS HANDLING SYSTEM FOR A POTENTIAL DROP PARTICLE ACCELERATOR
S. J. Marsik, F. R. Stevenson, and J. C. Dersimo Washington, NASA, 1967 7 p refs Presented at the Intern. Particle Accelerator Conf., Washington, D. C., 1–3 Mar. 1967 Sponsored by IEEE
(NASA-TM-X-52274) CFSTI: HC$3.00/MF$0.65 CSCL 14B

An improved sulphur hexafluoride (SF_6) gas handling system has been designed and built for a 3.0 MeV accelerator utilizing the original components provided with the accelerator. The purpose of the system is to remove the gas from the accelerator when opening is necessary, purify and store it, and return it to the vessel. The advantages are reduction in cycle time from 7 hours to about 3 hours, reduction in unretrieved gas from 7% to as little as 0.02%, compactness and improved purification resulting from liquefaction and additional filtering, and safe, reliable semi-automatic operation. Design considerations, fabrication techniques, and performance evaluation of the system are given. Author

N67-21220*# Goodyear Aerospace Corp., Akron, Ohio.
MOBILE 24-INCH SATELLITE PHOTOMETRIC OBSERVATORY Final Report
14 Oct. 1966 129 p refs
(Contract NAS1-5580)
(NASA-CR-66304) CFSTI: HC $3.00/MF $0.65 CSCL 17H

The objective of this contract was to design, fabricate, check out, and field test a transportable ground-based photometric facility for satellite observation and measurement. This was accomplished by providing an f/20 Cassegrainian telescope with a 24-inch aperture housed in a truck-mounted van. The forward compartment of the van houses the optical and electronic equipment, and the aft compartment deploys to form an observation deck. The self-supporting observatory contains electrical power generating equipment, air conditioning and heating equipment, control equipment, and instrumentation equipment. The facility was tested by measuring the light intensity of satellites in orbit and calibrated by measurements of the intensity of known stars. Author

N67-21357# Picatinny Arsenal, Dover, N. J. Ammunition Engineering Directorate.
ESTABLISHMENT OF SAFETY DESIGN CRITERIA FOR USE IN ENGINEERING OF EXPLOSIVE FACILITIES AND OPERATIONS Supporting Studies, Jan.–Dec. 1965
Richard M. Rindner, Stanley Wachtell, and Leon W. Saffian Dec. 1966 201 p refs
(PA-TR-3484; Rept.-8; AD-643871) CFSTI: HC $3.00/MF $0.65

This report presents a summary of activities from January-December 1965 on the supporting studies to establish a Safety Design Criteria Program under the technical management of Picatinny Arsenal. Work performed in these areas is described: A model scale slab test program (1/3 and 1/10 scale) to investigate the response of reinforced concrete to blast loads; a model scale bay test program to evaluate the explosive capacity of a bay structure and to establish the validity of scaling; a 1/3 scale modified C-13 cubicle test to demonstrate the use of new design and construction techniques; a full-scale test program to complete the investigation for compartmenting igloos for safe storage of small weapons, and development of new impulse curves in a cubicle type structure. TAB

N67-21369# Naval Research Lab., Washington, D. C.
THE 5-KJ VACUUM CLAMP SWITCH FOR THE PHAROS 2-MJ CAPACITOR BANK
Marvin P. Young 30 Aug. 1966 18 p refs
(NRL-6418; AD-644476) CFSTI: HC $3.00/MF $0.65

A five-kilojoule vacuum clamp switch was developed for Pharos magnetic-compression experiment. Four hundred and twenty of these switches will operate in parallel (at full two megajoules) as a passive clamp system for the main capacitor bank. The clamp switch is a variation of the Pharos air trigatron starting switch, except that it is housed in a commercial pyrex tee so that it can be evacuated to one millitorr. The tungsten–copper electrodes with a ten-millimeter gap will hold off the 20-kilovolt bank voltage at this pressure and yet trigger reliably at the low voltage as required. The electrodes, housing, and expansion chamber are assembled with O-ring vacuum seals, allowing rapid interchange or replacement of switch components. The trigger-pin assemblies are identical to those used for the atmospheric-gap starting switches. The clamp-switch terminals, which are an integral part of the electrodes, allow direct mounting across the capacitor high-voltage stud and ground plate. No modification to the existing capacitor bank was required for installation, so the experimental program was not disrupted. Life tests on seven prototype switches showed a reliable life of more than 4000 discharges at five kilojoules per switch. All failures were due to breakage of the pyrex tee housings. The expected life of all other switch components is many times this. Author (TAB)

N67-21381*# Israel Program for Scientific Translations, Ltd., Jerusalem.
WIND TUNNELS AND THEIR INSTRUMENTATION
S. M. Gorlin and I. I. Slezinger [1966] 607 p refs Transl. into ENGLISH of the book "Aeromekhanicheskie Izmerenia. Metody i Pribory" Moscow, Izd. Nauka, 1964 Published for NASA and NSF
(NASA-TT-F-346; TT-66-51026) CFSTI: HC $3.00/MF $0.65 CSCL 14B

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9. AUTOMATIC DATA RECORDING AND PROCESSING OF WIND-TUNNEL MEASUREMENTS p 564–592 refs (See N67-21390 10-14)

N67-21383*# Israel Program for Scientific Translations, Ltd., Jerusalem.
WIND TUNNELS AND INSTALLATIONS
In its Wind Tunnels and Their Instrumentation 1966 p 13–121 refs (See N67-21381 10-11) CFSTI: HC $3.00/MF $0.65

Detailed descriptions are presented on operating principles and various types of wind tunnels. Subsonic wind tunnels, in which the air is ejected to atmosphere after passage through the tunnel, are described and illustrated. Such items as the nozzle, test section, diffuser, fan installation, and settling chambers are mentioned. Next, transonic tunnels with test-section Mach number ranges from 0.85 to 1.4 and supersonic wind tunnels with operational Mach numbers above 1.4 or 1.5 are presented. Air drying and preheating, tunnel air-cooling systems, drives for continuous-operation tunnels, and low-density tunnels are among the topics considered. Hypersonic wind tunnels described include: hypersonic wind tunnels with air heaters, installations with adiabatic compression, shock tubes of various types, electric plasma wind tunnels, and installations for free flight of the model (ballistic ranges). Finally, wind tunnels for studying energies during aircraft take-off and the interaction between the aircraft and its propeller or jet stream are considered. S.P.

N67-21384*# Israel Program for Scientific Translations, Ltd., Jerusalem.
WIND-TUNNEL DESIGN CALCULATIONS
In its Wind Tunnels and Their Instrumentation 1966 p 122–155 refs (See N67-21381 10-11) CFSTI: HC $3.00/MF $0.65

The design calculations of wind tunnels involve the determination of the velocities, pressures, densities, and temperatures throughout the tunnel circuit in terms of the test-section velocity. Aerodynamic calculations begin from a draft tunnel layout based on the required test-section dimensions, Mach number, and Reynolds number. The type of test section (open or closed) is selected by considering the available power and the requirements of the tests. In addition, the contraction ratio of the nozzle must be chosen. For a given test-section velocity and with maximum permissible diffuser divergence, the contraction ratio determines the velocity

distribution throughout the tunnel circuit, the tunnel length and the geometry of all elements forming the return circuit. Aerodynamic calculation determines the compression ratio, discharge capacity, and power of the compressor or the fan necessary for obtaining the flow in the test section, and also the pressure loads on all the elements of the tunnel. Author

N67-21385*# Israel Program for Scientific Translations, Ltd., Jerusalem.

MEASUREMENT OF FLOW PARAMETERS IN WIND TUNNELS

In its Wind Tunnels and Their Instrumentation 1966 p 156–254 refs (See N67-21381 10-11) CFSTI: HC $3.00/MF $0.65

Test methods are presented for wind tunnels with steady conditions, i.e., the flow parameters are constant in time. The most important parameters in aerodynamic experiments are pressure, temperature, velocity, and direction of flow. Static and total pressure measurement are described as being important not only for determining the state of the gas, but also for determining the forces acting on it and the local velocity and the velocity of the undisturbed flow. The measurement of the Mach number and supersonic and subsonic flow velocity is described. In addition, measurement of flow direction, temperature in flow, density and boundary layer are presented. Traversing devices and combs or rakes of probes are discussed as instruments for investigating the distributions of velocity, pressure, and temperature within fluids. Finally, visual and optical methods of flow investigations are considered. S.P.

N67-21387*# Israel Program for Scientific Translations, Ltd., Jerusalem.

WIND-TUNNEL BALANCES

In its Wind Tunnels and Their Instrumentation 1966 p 326–437 refs (See N67-21381 10-11) CFSTI: HC $3.00/MF $0.65

Wind tunnel balances used to directly measure aerodynamic forces and moments are described. Wind tunnel balances are divided into two types depending on their location. In balances located outside the model and the test section of the wind tunnel the total aerodynamic force and moment are resolved into components with the aid of various mechanisms called mechanical balances. The model is installed in the test section with the aid of supports connected to these mechanisms. Wind tunnel balances located inside the model enable the influence of the supports to be excluded almost completely at supersonic flow velocities. Practical designs of internal wind tunnel balances became possible with the development of strain-gages based on the use of elastic systems whose deformations are determined by small strain gages. design examples are presented for balances of low-speed tunnels. Load capacities, accuracy, and rapidity of response are listed as the main characteristics of balance elements. Errors of external aerodynamic balances introduced by the balance elements and the system for resolving the forces into components are discussed. S.P.

N67-21388*# Israel Program for Scientific Translations, Ltd., Jerusalem.

TECHNIQUES AND METHODS OF AERODYNAMIC MEASUREMENTS

In its Wind Tunnels and Their Instrumentation 1966 p 438–526 refs (See N67-21381 10-11) CFSTI: HC $3.00/MF $0.65

Methods and techniques involving use of wind tunnels for aerodynamic measurements are examined. Methods of adjustment of the flow in subsonic, transonic, and supersonic wind tunnels are enumerated. Balance measurements consist in determining the aerodynamic coefficients of forces and moments acting on the model at different angles of attack and yaw. Determination of pressure and velocity distributions involves ingestigations of such factors as the pressure distributions on the surfaces of different bodies, and the velocity distributions around bodies and in side channels. The main types of tests on turbomachine elements are static tests of blade cascades in special wind tunnels and stand tests of separate steges of turbines and compressors. Methods of stationary tests of blade cascades are described. Testing of fans to determine their main characteristics as a machines creating the pressure drop necessary to induce gas flow is considered. Finally testing of wind turbines and ejectors and determining rotational derivatives are discussed. S.P.

N67-21389*# Israel Program for Scientific Translations, Ltd., Jerusalem.

PROCESSING THE RESULTS OF WIND-TUNNEL TESTS

In its Wind Tunnels and Their Instrumentation 1966 p 527–563 refs (See N67-21381 10-11) CFSTI: HC $3.00/MF $0.65

In order to reduce the number and magnitude of the corrections applied to the results of tests in wind tunnels, to increase the accuracy of these tests, and to make the results correspond closely to full-scale conditions, a study was made of methods of reducing the effects necessitating corrections. Reviewed are several basic formulas for the blockage of the model and the blockage of the wake in subsonic tunnels. In contrast to blockage effects of the model, the lift effect, which causes a change in the velocity distribution in the test section, appears even when the dimensions of the model are small in comparison with those of the tunnel. This effect disappears completely only at zero lift. Technical details are also given on lift effects in two-dimensional flow, and the influence of lift on the flow around the horizontal tail. The effects of different types of suspensions, supports, struts, etc., on the flow pattern in the wind tunnel and around the tested model are expressed in changes in the velocity and pressure distributions. For further analysis and comparison of the aerodynamic properties of the tested model with those of other models, the turbulence level, and the Reynolds number at which the test results were obtained have to be taken into account. R.Li.

N67-21470# Oak Ridge National Lab., Tenn.

OPERATIONAL SAFETY AND RADIATION PROTECTION FOR THE OAK RIDGE ISOCHRONOUS CYCLOTRON

J. A. Russell, Jr. and R. J. Jones Nov. 1966 16 p Revised
(Contract W-7405-ENG-26)
(ORNL-TM-364, Rev.) CFSTI: HC $3.00/MF $0.65

Two independent systems for providing operational safety and radiation protection for personnel at the Oak Ridge Isochronous Cyclotron are described in detail. A radiation alarm system monitors all hazardous areas. The cyclotron and all beam-use areas are operated completely by remote control; a complex system of interlocks and operation controls prevent access to any hazardous area while the cyclotron is in operation. This system is designed so that at least three interlocks must fail and both the person entering the room and the operator must make misjudgments before a radiation exposure can occur. In four years of cyclotron operation the systems have proved fully reliable and operationally very satisfactory. Author (NSA)

N67-21474# Maxwell Labs., Inc., San Diego, Calif.

DEVELOPMENT OF A 40 KV ENERGY STORAGE CAPACITOR, DECEMBER 3, 1965–APRIL 9, 1966

Terence J. Gooding and Bruce R. Hayworth Apr. 1966 18 p
Prepared for Lawrence Radiation Lab., Calif. Univ., Livermore
(Contract W-7405-ENG-48)
(MLR-1; UCRL-13209) CFSTI: HC $3.00/MF $0.65

The development and testing of a 20 μF, 40 kV energy storage capacitor are described. The design goals are: minimum life, 100 discharges; voltage reversal 85%; ringing frequency, 100 kc; energy density, 7 joules/in.^{3}; and the configuration is compatible with mounting in a rack designed for a standard 7-1/4 by 14 by 24-15/16 in. energy storage capacitor. The test data show that these design goals can be achieved. Also it is shown that small capacitors can be consistently hi-potted to an energy density of 17 jourles/in.^{3} in the winding. NSA

N67-21492# California Univ., Livermore. Lawrence Radiation Lab.

PROPOSED HIGH INJECTION RATE, VACUUM-TUBE-MODULATED, 1000A ELECTRON ACCELERATOR

N. C. Christofilos 15 Nov. 1966 9 p refs
(Contract W-7405-ENG-48)
(UCID-15046) CFSTI: HC$3.00/MF$0.65

A general outline and cost estimate of a proposed electron accelerator for the Astron facility are presented. The parameters of the proposed new accelerator are: electron energy, 4 MeV; beam current, 1000 A; pulse length, 0.3 μsec; and repetition rates, 500 kc in burst mode and 2500 pps in cw operation. NSA

N67-21493# California Univ., Berkeley. Lawrence Radiation Lab.

OPERATION OF THE HOMOPOLAR GUN II COIL SYSTEM

Klaus Halbach and Donald B. Hopkins 27 Sep. 1966 27 p refs Presented at the Symp. on Eng. Probl. of Controlled Thermonucl. Res., Gatlinburg, Tenn., 3–6 Oct. 1966
(Contract W-7405-ENG-48)
(UCRL-16997; CONF-661016-26) CFSTI: HC$3.00/MF$0.65

The coil system of the Homopolar Gun II experiment is designed to allow production of grossly different field configurations by properly adjusting the relative position and currents of the coils. The currents in the individual coils are controlled by crow-barring all coils but one with ignitrons at approximate times. The circumstances of the experiment require that the coils be in series and be energized by a single capacitor bank. The system used to rapidly create a desired field distribution is described. The adjustment of the many interacting parameters of the system can be reduced to the solution of linear algebraic equations. These are solved with the aid of an analog computer. An operational amplifier manifold sums, integrates, and (or) inverts search-coil signals. A storage oscilloscope conveniently displays the deviation of the accomplished field distribution from the desired field distribution. Author (NSA)

N67-21556# California Univ., Livermore. Lawrence Radiation Lab.

EXPERIMENTS WITH LARGE SUPERCONDUCTING SOLENOIDS

Clyde Taylor 30 Sep. 1966 11 p refs Presented at the Symp. on Eng. Probl. of Controlled Thermonucl. Res., Gatlinburg, Tenn., 3–6 Oct. 1966 Submitted for Publication
(Contract W-7405-ENG-48)
(UCRL-70031; CONF-661016-28) CFSTI: HC$3.00/MF$0.65

Large superconducting coils with partial insulation between turns used to achieve a high current density are described. A summary is given of the performance of five different types of coils. TAB

N67-21595# California Univ., Livermore. Lawrence Radiation Lab.

COIL SYSTEM DESIGN FOR A PROPOSED ASTRON DEVICE

Jack W. Beal 15 Sep. 1966 14 p refs
(Contract W-7405-ENG-48)
(UCRL-50136) CFSTI: HC$3.00/MF$0.65

The trapping field in Astron is provided primarily by a long solenoid formed of a series of separate short, ringlike coils aligned end to end. Two different coil systems are compared that could be used in such a solenoid for the Astron. One system has 4-in.-long coils spaced 8 in. between centers (called the 8-in. system), the other has 6-in.-long coils spaced 12 in. between centers (called the 12-in. system). The 12-in. system is found to be somewhat more sensitive to errors in coil alignment, dimensions, and current. The 12-in. system performs adequately, however, and has certain advantages over the 8-in. system in compatibility with existing equipment. In a related study of error fields produced by leads and crossovers to the coils, a coil constructed of two layers of windings was found to produce less error field than one constructed of four layers. Author (NSA)

N67-21604# Saskatchewan Univ., Saskatoon. Saskatchewan Accelerator Lab.

A STUDY OF A FOCUSSING SYSTEM FOR POSITRON BEAMS

Donald Edward Lobb (Ph.D. Thesis) Mar. 1966 230 p refs
(SAL-5)

A positron accelerator design proposed by Varian Associates (1962) (see also Nunan 1965) was studied. A high energy electron beam from a linear accelerator is allowed to strike a thick target located in a strong axial magnetic field. A short distance downstream of the target the field makes an abrupt transition to a weaker axial field which continues down the remaining length of the accelerator. Two methods of calculation of the expected system performance are presented: an analysis based on an idealized concept of a uniform short axial field with a discontinuous transition to a weaker uniform field and a numerical ray trace through a field specified by an axial magnetic field plot. The two methods agree quite well provided that after the abrupt transition the field is reasonably uniform. It is shown that a nonuniform field region between the abrupt transition and the final uniform field is undesirable for the case considered the integrated solid angle of acceptance is reduced by a factor of ~1/3. Assuming the idealized stepped-field configuration the expected performance of the system as a function of its parameters and of the phase space acceptance of the downstream facility was analyzed. With increasing phase space acceptance the accepted positron current is found to increase faster than predicted under an assumption of constant phase space density. It is also shown that the useful source spot size increases with increasing phase space acceptance. A formula is given for optimizing the shape of the phase space acceptance. It is also demonstrated that a low design energy and high axial magnetic fields are desirable for optimum acceptance. An important result is that the useful source spot size is typically 1 to 2 mm diameter, depending on the system parameters. For source spots much larger than this the accepted positron yield is much smaller than that calculated for axial point source. Author (NSA)

N67-21826# Instituto de Asuntos Nucleares, Bogota (Columbia). Division Reactor.

GENERAL GUIDE FOR IRRADIATIONS IN THE RESEARCH AND EXPERIMENTAL REACTOR IAN-R1 [GUIA GENERAL PARA IRRADIACIONES EN EL REACTOR DE ENSENANZA E INVESTIGACION IAN-R1]

Edmundo Sandoval, Antonio Barragan, and Manuel Gasabianca Jun. 1965 37 p refs In SPANISH
(IAN-R1)

The experimental irradiation facilities of the IAN-R1 reactor and the physical characteristics of these facilities are described.

Basic information on the calculation of activities and reactivity is presented. The procedures that should be followed in order to obtain authorization for the use of the irradiation facilities are indicated. The most common errors in irradiation experiments are tabulated. NSA

N67-21828# Midwestern Universities Research Association, Stoughton, Wis.
RF PERTURBATION MEASUREMENTS IN LONG LINAC CAVITIES
C. W. Owen, C. A. Radmer, and D. E. Young 3 Oct. 1966 22 p refs Presented at the 1966 Linear Accelerator Conf., Los Alamos, N. Mex., 3–7 Oct. 1966 Prepared for Argonne Natl. Lab.
(Contract W-31-109-ENG-38)
(MURA-723; CONF-661021-24) CFSTI: HC $3.00/MF $0.65

Equipment and procedures are described for measuring the axial accelerating electric field in long linear accelerator standing wave cavities. The method used is the usual one of measuring the change in resonant frequency caused by a small perturbing sphere on the axis of the cavity. This is done by specially developed equipment connected to an on-line digital computer. Readings are taken at millimeter intervals along the axis allowing the fields to be accurately plotted, integrated, and compared. The method is more rapid and accurate than has previously been possible, and analyses can be carried out readily on the data. The equipment has been used on the 50 MeV linac injector for the Zero Gradient Synchrotron at Argonne National Laboratory. The increased knowledge of the axial accelerating electric field obtained with this equipment should allow improved performance of the linac. Author (NSA)

N67-21864# General Electric Co., Philadelphia, Pa. Missile and Space Div.
SUPERPRESSURE STUDIES HIGH EXPLOSIVE TEST SITE. FACILITIES AND CAPABILITIES Technical Information Series
Howard W. Semon Dec. 1966 28 p
(R66SD63; AD-803597) CFSTI: HC $3.00/MF $0.65

This paper describes a test facility that was established specifically to do work involving high energy rate processes requiring a degree of isolation unavailable in normal laboratory space. It was written primarily to publicize the existence of such a facility and to point out the wide range of experiments that can be performed at the test site. Author (TAB)

N67-21872# Naval Research Lab., Washington, D. C.
COMPUTER PROGRAM FOR THE NRL SATELLITE POSITION DISPLAY
R. J. Orsino and T. L. Francavilla 5 Dec. 1966 54 p refs
(NRL-6446; AD-645180) CFSTI: HC $3.00/MF $0.65

A computer driven satellite display has recently been developed and evaluated at the Naval Research Laboratory. This equipment, designated as the NRL Satellite position Prediction And Display (SPAD), provides a considerable amount of display control versatility. Up to eleven satellites can be selected either individually or by category from a repertoire of 88 satellites. These selected satellites are then updated and displayed in either real time or at an accelerated time. Several display modes are available at an operators command, namely, world map, rectangular expanded mode, and polar expanded mode. A commercial equivalent of the AN/UYK-1 computer was used in the research version of SPAD. Since the program was written in a language peculiar to this machine, the program listings and codings are omitted from the present report. However, included in this report are the complete set of computer program flow diagrams and a brief description of the interrupt service routines along with their corresponding subroutines. Characteristics of the AN/UYK-1 computer, operator control panel provisions and possible future program modifications are discussed. The contents of this report should be a sufficient indication of the program philosophy. This philosophy, with appropriate minor changes, could be implemented by any suitable language. Author (TAB)

12 FLUID MECHANICS

Includes boundary-layer flow; compressible flow; gas dynamics; hydrodynamics; and turbulence. For related information see also: 01 Aerodynamics; and 33 Thermodynamics and Combustion.

N67-20399 Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
FLOW OF A SUPERSONIC AIRSTREAM PAST A SPHERE, WITH CONSIDERATION OF EQUILIBRIUM RADIATION
V. K. Vertushkin *In its* Cosmic Res. 23 Jun. 1966 p 263–267 refs (See N67-20381 10-30) CFSTI: HC $3.00/MF $0.65

Presented are equations for describing the flow of a stream of an ideal radiating gas past a sphere and the influence of an equilibrium radiation on the distribution of the gas dynamic parameters behind the shock wave. On the basis of the proposed equations it was found that: (1) radiation exerts the strongest influence on the distribution of the density and enthalpy of the radiating gas; (2) The effect of radiation on the distribution of velocities and the geometry of the flow is small; (3) Additional cooling of the air by radiation results in a sharp decrease in enthalpy and an increase in density at the surface of the body, which indicates the presence of a radiation entropy layer; and (4) The presence of the entropy layer will exert significant influence on the boundary layer and on the processes of heat exchange between the gas and the spherical body. S.C.W.

N67-20526# Massachusetts Inst. of Tech., Cambridge. Gas Turbine Lab.
SEPARATION OF TURBULENT, INCOMPRESSIBLE FLOW FROM A CURVED BACKWARD-FACING STEP Technical Report, Apr.–Jul. 1966
George R. Nice, Wu-Yang Tseng, and Hal L. Moses Jun. 1966 37 p refs
(Contract Nonr-1841(91))
(Rept.-87; AD-642521) CFSTI: HC $3.00/MF $0.65

An experimental investigation of turbulent, incompressible flow separation over curved and sharp, backward-facing steps is presented with results for various step heights. Mean velocities in the separating boundary layer as well as the downstream shear layer were recorded. The static pressure in the separated region was determined with a spherical probe. With the curved step, the boundary layer separated at approximately 28 degrees; the reattachment lengths were somewhat less and the base pressures slightly higher than those with the sharp step. Author (TAB)

N67-20539# Physics, Engineering, Chemistry Corp., Boulder, Colo.
CHARACTERISTICS OF CONFINED DENSE PHASE FLOW OF GRANULAR SOLIDS DRIVEN BY COMPRESSED AIR Final Report, 8 Jun. 1964–15 Sep. 1966
Sep. 1966 184 p refs
(Contract DA-49-092-ARO-48)
(AD-642845) CFSTI: HC $3.00/MF $0.65

The transport of sand was studied in 1, 2, 3, and 4-inch transparent plastic pipes of lengths ranging from 75 to 800 feet. Several distinctly different modes of sand transport were observed; they might be described as (1) shifting-dune; (2) a transition region of air velocity in which the dunes become more like plugs filling the whole pipe section, and (3) slug flow. There is a gain in lineal velocity of sand particles through the first half of the line length, after which velocity remains constant; this effect is thought to be due in part to the rapid expansion of the carrying air in the first half of the pipe. Flow up inclines and vertical flow were also studied. The effect of a wooden driving piston to assist in horizontal flow is reported. Considerable effort was devoted to the problem of deriving theoretical expressions which will describe solids flow and gas flow as a function of applied pressure, amount of sand in the conveyance pipe, cross-sectional areas of pipe and sand size. Author (TAB)

N67-20547# Ohio State Univ. Research Foundation, Columbus.
AN EXPERIMENTAL INVESTIGATION OF THE INFLUENCE OF ELECTROSTATIC FIELDS ON FLOW ATTACHMENT
Gary P. Eiler and Henry R. Velkoff 15 Aug. 1966 98 p refs
(Contract DA-31-124-ARO(D)-246)
(Rept.-4; AROD-4942-1; AD-642869) CFSTI: HC $3.00/MF $0.65

An experimental investigation was conducted to determine whether an electrostatic field could be used to affect the attachment of an air stream to a flat surface. Tests were run using a fluid-amplifier type device in which corona wind was fed through the control ports of the device. It was found that the fluid stream could be made to detach from one wall, flip over to the opposite wall, and attach to that wall. The air stream could then be flipped back to the original wall by activating the opposite corona wind control port. Pressure distribution and velocity profile data were taken which indicated that by suitable design symmetric flip-flop of the fluid stream in the device could be achieved. Author (TAB)

N67-20550# General Dynamics Corp., San Diego, Calif. John Jay Hopkins Lab. for Pure and Applied Science.
ELECTRONIC AND IONIC REACTIONS IN ATMOSPHERIC GASES Yearly Technical Summary Report, Sep. 1, 1965–Aug. 31, 1966
B. R. Turner, D. M. J. Compton, and J. Wm. McGowan 14 Nov. 1966 79 p refs
(Contract DA-49-146-XZ-354)
(GA-7419; DASA-1863; AD-643093) CFSTI: HC $3.00/MF $0.65

The cross sections for charge transfer in collisions between nitric oxide and atomic and molecular positive ions of oxygen and nitrogen were measured in the energy range from 3 to 200 eV in a crossed beam experiment. A smooth interpolation is made between these results and the rate coefficients obtained at thermal energy by the afterglow technique. Using similar information for the reaction O2+ + N2 to O2 + N2+, a technique to determine the fractional concentration of the excited ions in an ion beam as a function of source electron energy was developed. Several negative ion reactions, primarily charge transfer, were investigated in the energy range 2 eV to several hundred eV. Development work on an atomic oxygen source was carried out, and the results are described. The source is suitable for the measurement of relative cross sections. The dependence of the cross section for the reaction N2O + e to N2 + O(-) on N2O temperature was measured to be small, unlike that for similar reactions for O2. The ionization cross section near threshold for O2 was analyzed, and an interpretation of the ionization cross section is given for O2, N2 and H2 in terms of the relative contributions of direct and indirect ionization processes. TAB

N67-20557# Stevens Inst. of Tech., Hoboken, N. J.
EXACT TREATMENT OF THE HELICOIDAL WAKE IN THE PROPELLER LIFTING-SURFACE THEORY
Stavros Tsakonas, Chu-yung Chen, and Winifred R. Jacobs Aug. 1966 62 p refs
(Contract Nonr-263(55))
(Rept.-1117; AD-642937) CFSTI: HC $3.00/MF $0.65

An accurate mathematical treatment of the helicoidal wake supersedes the deformation of the helicoidal integral path to a staircase path. The kernel function is derived with correct directional derivatives normal to the helicoidal surface as well as with the simplified derivatives assumed in previous studies. The propeller blade is of sector form with arbitrary pitch, not necessarily low, and the loading distribution is taken to be that of a flat plate. The results of numerical calculations for the consistent mathematical model which treats the helicoidal wake exactly and uses the correct directional derivatives normal to the helicoid are found to compare favorably with the results obtained previously when a staircase approximation of the wake was used with the simplified, but physically consistent, directional derivatives in the axial direction. The closeness of the results for a propeller of not too low pitch indicates that the staircase approximation, which was introduced for low pitch angle, is a satisfactory model. Author (TAB)

N67-20560# Pennsylvania State Univ., University Park. Dept. of Aerospace Engineering.
LARGE EDDY STRUCTURE OF A TURBULENT WAKE
Fred R. Payne (Ph.D. Thesis) Sep. 1966 180 p refs
(Contract Nonr-656(33))
(AD-642298) CFSTI: HC $3.00/MF $0.65

Lumley's objective definition of the intuitive concept of 'large eddy' leads to an eigenvalue problem. In this report, the first few eigenfunctions are determined for velocity correlations measured in the turbulent wake of a circular cylinder; these are interpreted in terms of the associated representation theorems. The eigenvalue problem was solved in Fourier space and the most energetic eigenfunction was transformed to 'real space'. This mode is a vortex pair approximately normal to the plane of the wake; its planes of circulation are normal to the direction of positive maximum mean strain rate. The structure is qualitatively similar to Grant's intuitive model based on the same data. Lumley's interpretation of the most energetic modes as the large eddies is verified as correct. However, the strong non-linearity of the dynamics of these eddies (suggested by the apparent dominance of vortex stretching) combined with the slow decay of eigenvalues with increasing order, implies that analytic solution of the equations of motion for these eddies will be a formidable problem. Author (TAB)

N67-20571# RAND Corp., Santa Monica, Calif.
RECENT DEVELOPMENTS IN THE FLUID MECHANICS OF HYPERSONIC WAKES
Paul S. Lykoudis Nov. 1966 37 p refs Presented at the 17th Intern. Astronautical Congr., Madrid, 10–15 Oct. 1966
(P-3451; AD-642286) CFSTI: HC $3.00/MF $0.65

During the last six years or so, a great deal of work has been done in an effort to understand the fluid mechanics of wakes developed behind bodies flying at hypersonic speeds in dense atmospheres. A review of this subject summarizing all relevant work up to about the end of 1964 was recently published. Until that time, very little experimental work was available, and some of the theoretical problems were being posed rather than solved. The present paper makes an attempt to present and critically evaluate the theoretical and experimental work on this subject as it appeared essentially after January 1965. The following areas are emphasized: theoretical and experimental work done to determine the flow characteristics in the fluid expension after separation, in the free shear layer, and in the base, recirculation, and recompression regions; work on the mechanism of transition from laminar to turbulent flow in the wake; theoretical and experimental work dealing with the statistical properties of the turbulent intermittency region

observed at the edge of the turbulent wake core; and finally, work related to the understanding of the chemistry of production and removal of free electrons in the presence of compressible wake turbulence. Author (TAB)

N67-20584# Cornell Aeronautical Lab., Inc., Buffalo, N. Y.
SPEED-RATIO MEASUREMENTS IN NONEQUILIBRIUM NOZZLE AND FREE-JET EXPANSIONS
R. J. Vidal, G. T. Skinner, and J. A. Bartz Oct. 1966 38 p refs Presented at the 5th Intern. Symp. on Rarefied Gas Dyn., Oxford, 4–8 Jul. 1966 Submitted for publication
(Contracts AF 49(638)-1433; AF 49(638)-1490)
(CAL-AF-2041-A-I; AFOSR-66-1975; AD-642433) CFSTI: HC $3.00/MF $0.65

A new probe is described for determining the molecular speed ratio in low-density flows. The probe functions by measuring stagnation point heat transfer and flat plate heat transfer in free-molecule flow. The ratio of these two measurements can be interpreted as the speed ratio. Experimental shock tunnel data obtained in essentially undissociated air are presented to calibrate the probe and to demonstrate the accuracy of the speed-ratio determinations. Following this, measurements obtained in high temperature, dissociated air are presented to show the consequences of nozzle nonequilibrium. These speed-ratio measurements are in good agreement with existing theory when vibrational freezing is taken into account. Exploratory speed-ratio measurements in a free-jet expansion of argon are compared with existing theory to demonstrate that the translational temperature departs from an isentropic behavior at low densities. Author (TAB)

N67-20608# Aeronautical Research Council (Gt. Brit.)
SOME DEVELOPMENTS IN THE THEORY OF VORTEX BREAKDOWN
T. Brooke Benjamin (Cambridge Univ.) 25 Apr. 1966 46 p refs
(ARC-27945; AD-642179) CFSTI: HC $3.00/MF $0.65

The primary aim of the analysis is to consolidate the ideas of the conjugate-flow theory, which proposes that vortex breakdown is fundamentally a transition from a uniform state of swirling flow to one featuring stationary waves of finite amplitude. Author (TAB)

N67-20627# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
HYPERSONIC FLOW AROUND A TRIANGULAR PLATE WITH BLUNTED LEADING EDGES [GIPERZVUKOVOYE OBTEKHANIYE TREUGOL'NOY PLASTINY S PRITUPLENNYMI PEREDNIMI KROMKAMI]
V. V. Lunev 21 Nov. 1966 19 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Mekhan. i Mashinostr. (Moscow), no. 3, 1965 p 9–16
(FTD-TT-65-1907; TT-67-60202; AD-643644) CFSTI: HC $3.00/MF $0.65

An analysis is made of the problem of a hypersonic flow without an angle of attack around a triangular plate with an angle 2δ having a vertex with a resistance c sub x(d) constant over the edge, where d is the thickness and cx is the coefficient of resistance of the transverse section of the edge. For obtaining the reviewed qualitative results, a very simple two-layer scheme of flow is taken in whose framework the area is sufficiently removed from the forward edge, there is found the pressure distribution over the plate, the thickness of the high-entropy layer and the distance of the average speed in it. Author (TAB)

N67-20639# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ABOUT PRANDTL'S INTEGRODIFFERENTIAL EQUATION
I. N. Vekua 2 Sep. 1966 14 p refs Transl. into ENGLISH from Prikl. Mat. i Mekh. (Moscow), v. 9, no. 2, 1945 p 143–150
(FTD-HT-66-149; TT-67-60262; AD-643738) CFSTI: HC $3.00/MF $0.65

Air flow along a wing of finite span is analyzed mathematically. TAB

N67-20648# Harry Diamond Labs., Washington, D. C.
FLUERICS. 22: AN EXPERIMENTAL STUDY OF BOUNDED AND CONFINED JETS
Richard D. Trapani Nov. 1966 61 p refs
(AD-644737) CFSTI: HC $3.00/MF $0.65

An experimental study was conducted to determine the characteristics of a turbulent bounded jet and a confined jet. The bounded jet (bounded by plates above and below) of aspect ratio 7 was found to have characteristics similar to those of the free jet with respect to velocity profiles, centerline velocity decay, and spread growth. However, the values of the spread parameter were higher than the Reichardt value. This was found to be caused by the bounding plates reducing the amount of air entrained by the jet. Three configurations of nozzle aspect ratio and channel ratio were used in the confined jet (enclosed on the top, bottom and sides) studies. The confined jet, spreading under the influence of an adverse pressure gradient, differed in behavior from the free jet. It was characterized by nonlinear spreading at a faster rate than that of the free jet. Author (TAB)

N67-20675# Technische Hochschule Aachen (West Germany). Institut fuer Mechanik.
LAMINAR BOUNDARY LAYER FLOW AND STABILITY AT LONGITUDINALLY CURVED WALLS Final Scientific Report, 1 Sep. 1963–31 Aug. 1966
F. Schultz-Grunow 31 Aug. 1966 61 p refs
(Contract AF 61(052)-744)
(AD-642365) CFSTI: HC $3.00/MF $0.65

The work deals with incompressible plane and steady laminar boundary layer flow free of separation along semi-infinite walls with longitudinal curvature. Two problems are of main interest once the boundary layer flow in a more precise approximation as known by Prandtl Blasius and the stability. Author (TAB)

N67-20680# Brown Univ., Providence, R. I.
SURFACE CURRENTS INDUCED ON WEDGES UNDER WAVE ILLUMINATION
Roberto Romano and Donald M. Bolle Sep. 1966 36 p refs
(Contract AF 19(628)-5846)
(AFCRL-66-742; SR-3; AD-644685) CFSTI: HC $3.00/MF $0.65

Magnitudes and phases of the surface currents induced on perfectly conducting infinite wedges are presented as a function of the distance from the wedge apex. Results are presented for wedges with interior angles of 60, 90 and 120 degrees for various angles of incidence. Results are given for the polarization of the incident plane both in and normal to the plane of incidence. It is seen that, for the illuminated faces of the wedge, the physical optics result is approached within two wavelengths from the wedge apex and, in many cases, within about one wavelength. Author (TAB)

N67-20687# Naval Ordnance Test Station, Pasadena, Calif.
AN EXPERIMENTAL STUDY OF GRID TURBULENCE IN DILUTE HIGH-POLYMER SOLUTIONS
A. G. Fabula Nov. 1966 54 p refs Presented at ONR 6th Symp. on Naval Hydrodyn., Washington, D. C., 28 Sep.–4 Oct. 1966
(NOTS-TP-4225; AD-644148) CFSTI: HC $3.00/MF $0.65

Longitudinal, one-dimensional turbulence spectra were measured behind a towed grid in dilute aqueous high-polymer solutions. Several types of hot-film flowmeters with constant-temperature bridges were used, with emphasis on quartz-coated, platinum-film sensors of conical shape. Measurements in water were consistent with wind-tunnel measurements. Cylindrical sensors were found unsuitable. The additives were poly(ethylene oxides), polyacrylamides, and guar gum. Concentrations of up to 137 ppm were used. The guar gum produced temporary suspensions which were not suitable for turbulence measurements because of high noise level. With the other additives, the sensor signal near the grid included a high-frequency component (called raggedness) which was attributed to temporary (or temporarily altered) inhomogeneity caused by the grid bars. Three types of spectral effects were the distortion due to raggedness, a greater experimental scatter near the grid in newly prepared solutions, and the predictable shift due to viscosity increase. Author (TAB)

N67-20693# California Univ., Berkeley. Coll. of Engineering.
THE SECOND-ORDER THEORY OF CYLINDERS OSCILLATING VERTICALLY IN A FREE SURFACE
Choung Mook Lee Sep. 1966 155 p refs
(Contract N00014-66-C0057-A02)
(NA-66-7; AD-644183) CFSTI: HC $3.00/MF $0.65

Let a cylinder be half submerged with its generators parallel to the water surface, and suppose it to be symmetric about a vertical axis. Further suppose the cylinder to be oscillating harmonically in a vertical direction. The pressure distribution about the cylinder, the force acting upon it, and the waves generated by it are computed through the second order of a perturbation series in the ratio of amplitude of motion to beam. The resulting potential-theory problems are solved by placing singularities of all orders at the intersection of the water surface with the vertical axis of symmetry and determining their strengths from the boundary condition on the body. Numerical computations are made for a circular cylinder and for a U-shaped cylinder. The results are presented in graphs. Author (TAB)

N67-20727# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
VISUALIZATION OF TRANSITION PHENOMENA IN THE BOUNDARY LAYER ON THE BLADES OF A TURBINE CASCADE
A. Ya. Ipatenko and A. M. Antonov 29 Jul. 1966 10 p refs Transl. into ENGLISH from Izv. Vysshikh Uchebn. Zavedenii, Aviats. Tekh. (Kazan), no. 3, 1965 p 76–82
(FTD-HT-66-319; TT-67-60323; AD-644167) CFSTI: HC $3.00/MF $0.65

In investigating the flow in the boundary layer on the blades of a cascade to determine the line of transition from laminar flow to turbulent flow and to establish the boundaries of the effect of the face walls of the channel, the kaolin and the sublimation methods can be successively applied. Both methods are approximately equivalent. The kaolin method is somewhat more convenient and gives a clearer boundary between the regions. Author (TAB)

N67-21012# California Univ., Livermore. Lawrence Radiation Lab.
ON TWO-DIMENSIONAL STATISTICAL HYDRODYNAMICS
M. Neuman Jul. 1966 85 p refs
(Contract W-7405-ENG-48)
(UCRL-50105) CFSTI: HC $3.00/MF $0.65

The question of expanding a finite box to an infinite plane is discussed in detail; real and complex infinite dimensional phase spaces are introduced and also some related notions pertaining to holomorphic and antiholomorphic properties of functions on such spaces. The countable infinity of first integrals in the limit of vanishing viscosity is considered. The motion in phase space, both globally and locally, is described. Following other discussions, a marginal distribution for the vorticity in a single mode is derived: the analog of the Maxwell-Boltzmann distribution. NSA

N67-21025# Brookhaven National Lab., Upton, N. Y.
LIQUIDS
G. H. Vineyard *In its* Inelastic Scattering of Neutrons by Condensed Systems Mar. 1966 p 16–22 (See N67-21022 10-24) CFSTI: HC $3.00/MF $0.65

Current understanding of the atomic structure and atomic dynamics of simple liquids is reviewed. In the past decade the theory of transport coefficients and of scattering processes has been improved by the introduction of time-displaced correlation functions. Results are mainly formal, however, and specific calculations still depend on models, a great many of which have been proposed. Another major advance has come recently from computer "experiments" on classical fluids. The inter-relation of these methods with neutron scattering will be discussed. Author (NSA)

N67-21101 Marconi Co., Ltd., Chelmsford (England).
A PNEUMATIC TAPE READER
H. M. Rosenbaum and J. S. Cant 1967 12 p refs Presented at the 2d Cranfield Fluidics Conf., Cambridge, England, 3–5 Jan. 1967 Paper E2
CFSTI: $3.00

This paper describes the design, research and development that has been carried out in producing an experimental low speed reader for standard 5 or 8 hole punched paper tape in which both the digital output and the tape transport are achieved pneumatically. A back pressure method of hole sensing has been shown to work successfully not only for the present reading speed requirements of 20 lines per second but in addition at about 15 times this speed. Author

N67-21103 British Aircraft Corp., Stevenage (England).
DESIGN AND MANUFACTURE OF PURE FLUID ELEMENTS
C. C. Brown 1967 16 p refs Presented at the 2d Cranfield Fluidics Conf., Cambridge, England, 3–5 Jan. 1967 Paper F4
CFSTI: $3.00

The design to a specification of two wall attachment fluid elements, the Flip flop and the OR-NOR gate is described. The elements were developed by empirical methods, and details are given of the geometric changes involved. The Dycril process as a means of manufacturing fluid elements and circuits is described along with a method of casting in Araldite using masters made in Dycril and silicone rubber intermediate molds. Author

N67-21104 Birmingham Univ. (England).
SOME EXPERIMENTS ON A FREE FOIL SWITCHING DEVICE
K. Foster and D. A. Retallick 1967 19 p ref Presented at the 2d Cranfield Fluidics Conf., Cambridge, England, 3–5 Jan. 1967 Paper D1
CFSTI: $3.00

Experiments carried out on a type of moving part fluid logic element, the foil element, are reported. The operating principles are briefly described, several applications are suggested, and particular

attention is paid to the use of the foil valve in combination with other elements. Static and dynamic test results are shown for four of the configurations. Author

N67-21105 Birmingham Univ. (England).
A FLUIDIC SUBTRACTOR FOR DIGITAL CLOSED-LOOP CONTROL SYSTEMS
G. A. Parker and B. Jones 1967 24 p refs Presented at the 2d Cranfield Fluidics Conf., Cambridge, England, 3–5 Jan. 1967 Paper H1
CFSTI: $3.00

An assessment is given of the static performance of three types of fluidic binary full-adder configurations suitable for performing the subtraction function which is required to generate the error signal in a closed-loop control system. A graphical matching analysis using experimentally determined static input and output characteristics of the individual logic units, is employed to predict the minimum operating conditions of each type of full-adder for one condition of loading. Insight is also given into the development of a passive half-adder element, that is the fundamental unit upon which each of three types of full-adder are based. From an initial comparison of air consumption and speed of response, one of the configurations is chosen as being suitable for development into integrated circuit form. The dynamic characteristics and the air consumption requirements of a miniaturised full-adder stage using a signal from a statically matched pneumatic position encoder are fully reported. It is concluded that the circuit has an acceptable air consumption and that good dynamic operation is obtained over a wide range of input conditions, making it suitable for continuous mode closed-loop control systems. Author

N67-21106 Institute TNO for Mechanical Constructions, Delft (Netherlands).
ON THE DESIGN, CHARACTERISTICS AND PRODUCTION OF TURBULENCE AMPLIFIERS
H. A. M. Verhelst 1967 15 p refs Presented at the 2d Cranfield Fluidics Conf., Cambridge, England, 3–5 Jan. 1967 Paper F2
CFSTI: $3.00

Because, at this moment, a theoretical description to be used for the design of turbulence amplifiers is not yet available, these elements have to be designed experimentally. This paper presents experimental results and describes the influence of parameter changes on the amplifier performance with the help of static characteristics. Three production techniques for planar turbulence amplifiers are compared with respect to the relative cost depending on the production per year. A mounting system for single planar elements, which have been made by injection molding, is briefly discussed and reproducibility figures and performance data are given. Author

N67-21107 Technische Hogeschool, Delft (Netherlands).
THE APPLICATION OF FLUIDICS IN NUMERICAL CONTROL OF MACHINE TOOLS
H. P. Stal and J. Bulk (Inst. TNO for Mech. Construct.) 1967 16 p refs Presented at the 2d Cranfield Fluidics Conf., Cambridge, England, 3–5 Jan. 1967 Paper J5
CFSTI: $3.00

Numerical positioning in machine tools by means of fluidics may offer advantages, especially in small workshops. The application of fluid amplifiers is limited by their relative slowness of operation. Therefore positioning with the aid of these devices must occur in steps, beginning with a coarse and continuing to a finer resolution, each step to be performed with adapted speed. A demonstration model of an all-fluidic numerically controlled point-to-point positioning system using turbulence amplifiers is described. Details of the switching circuits are given. Author

N67-21108 Officine di Villar Perosa, S.P.A., Turin (Italy).
SOME INDUSTRIAL APPLICATIONS OF THE MODUFLOG SYSTEMS
M. Monge 1967 32 p Presented at the 2d Cranfield Fluidics Conf., Cambridge, England, 3–5 Jan. 1967 Paper J4
CFSTI: $3.00

After a quick review of the essential characteristics of the Moduflog system, a practical application for an automatic checking and grading of geometric dimensions is illustrated—an automatic control of assembled rolling bearings. An on-the-line automatic control of cylinder blocks for the Fiat 124 car, with the accent on the sequential-control fluid-logic circuit and circuital interconnection problems, is presented. Author

N67-21109 Borough Polytechnic, London (England).
INVESTIGATION INTO THE BEHAVIOUR OF A JET INTERACTION PROPORTIONAL AMPLIFIER
J. F. Douglas and R. S. Neve (London Univ.) 1967 22 p refs Presented at the 2d Cranfield Fluidics Conf., Cambridge, England, 3–5 Jan. 1967 Paper C3
CFSTI: $3.00

An investigation into the behavior of a momentum-effect jet-interaction amplifier is described. Experimental studies were made using a water table and also an enlarged scale pneumatic model. A theory is put forward for the prediction of the amplifier gain on the basis of momentum, mass flow, and power. Experimental evidence is given in support of this theory. Author

N67-21110 Deutsche Akademie der Wissenschaften zu Rossendorf (East Germany).
DESIGN OF INPUTS AND OUTPUTS OF DIGITAL PNEUMATIC JET COMPONENTS FOR ADAPTATION TO THE STANDARDISED PRESSURE RANGE
G. R. Koenig 1967 16 p refs Presented at the 2d Cranfield Fluidics Conf., Cambridge, England, 3–5 Jan. 1967 Paper B5
CFSTI: $3.00

The jet assembly, which works in a pressure range below the standardized range from 3 to 15 psig, must be adapted to the standardized pressure range for efficient utilization in pneumatic installations. This means that a certain amount of auxiliary equipment is required for preparing and reducing the standardized auxiliary pressure and for reinforcing the signal outputs. This additional equipment differs according to whether or not switch diffusors, i.e., discrete boundary layer amplifiers without separating wedge are used for admitting auxiliary energy to the signal input and signal output. Using interference effects which have been observed, it is shown how the pressure reducing elements and auxiliary air intakes can be designed to suit the jet elements. Other functional properties of the components are derived from the control of the disturbing or interference effects mentioned above. Also, means for reinforcing the signals in the standardized pressure range and processing the signals in this range are pointed out. Author

N67-21111 Siemens and Halske A. G., Munich (West Germany).
FLOW STABILITY IN BI-STABLE FLUID ELEMENTS
A. W. Rechten 1967 15 p refs Presented at the 2d Cranfield Fluidics Conf., Cambridge, England, 3–5 Jan. 1967 Paper B8
CFSTI: $3.00

Pressure recovery in bi-stable fluid elements can be increased by stationary latching vortices. These are formed when the elements are suitably shaped, and stabilize the assigned direction of the flow. Optimum shape, size, and configuration of the vortices are discussed, and a comparison is made with experimental results obtained with models using the water table. Author

N67-21112# Glaettli (H. H.), Kussnacht (Switzerland).
MACH- AND CAVITATION NUMBER EFFECTS IN FLUID DYNAMIC ELEMENTS AND CIRCUITS
H. H. Glaettli 1967 7 p refs Presented at the 2d Cranfield Fluidics Conf., Cambridge, England, 3–5 Jan. 1967 Paper B8
CFSTI: HC $3.00/MF $0.65

Mach and cavitation number effects manifest themselves in the following three different manners. (a) They set upper limits to operating pressure, power consumption and therefore also power output. Together with the requirement of a minimum Reynolds number this calls for a minimum size and response time. (b) They influence the general behaviour of isolated elements. (c) They affect the stability of complete circuits. Only a few remarks are concerned with the first effect, which has been reported earlier. Drastic effects occur when highly nonlinear components, such as bi- or tri-stable elements are investigated. This also explains why fluid elements may be influenced by much lower Mach numbers than those which require attention in general aerodynamics. The fact that miniaturized pneumatic circuits may behave less stably than a similar setup of larger size, although all components are especially designed for the Mach number in question, is easily explained by comparing the resonant frequency of connecting lines with the cut-off frequency of the active elements. Experimental development of elements, as well as of circuits, which have to work at Mach numbers of approximately 0.2 or higher after miniaturization, requires the same Mach and Reynolds numbers. Some possibilities to achieve this are discussed. Author

N67-21113# Printing, Packaging and Allied Trades Research Association (England).
THE DESIGN OF JET-INTERACTION AMPLIFIERS USING SUPER-CRITICAL PRESSURE RATIOS
A. B. Render 1967 12 p Presented at the 2d Cranfield Fluidics Conf., Cambridge, England, 3–5 Jan. 1967 Paper C2
CFSTI: HC $3.00/MF $0.65

The use of jet-interaction amplifiers to give very high output pressures will necessitate operation with supersonic jet velocities. Results are presented for tests with high pressure jets to determine the nature of the total pressure distribution and the manner in which it varies with jet deflection. A concise method of presenting data is outlined, with a view to providing a simple means of designing pressure amplifiers to meet specific gain requirements. Author

N67-21114# Harry Diamond Labs., Washington, D. C.
EXPERIMENTAL ANALYSIS OF DIGITAL FLUERIC AMPLIFIERS FOR PROPORTIONAL THRUST CONTROL
Carl J. Campagnuolo and Allen B. Holmes 1967 20 p refs Presented at the 2d Cranfield Fluidics Conf., Cambridge, England, 3–5 Jan. 1967 Paper K3
CFSTI: HC $3.00/MF $0.65

A flueric control system has been constructed capable of amplifying proportional flow signals from a gyroscope to provide large reaction forces. The system uses staged digital amplifiers and produces a proportional output. The proportionality is attained by varying the time an oscillating jet spends in each of two output reaction nozzles. Output thrust measurements are included to show the gain, linearity, and overall system performance. The design, fabrication, and analysis of the components are discussed. The system has a power gain of 1×10^8 and a flow gain of 1.3×10^4 and delivers a maximum thrust of 80 lbs. Author

N67-21115# United Kingdom Atomic Energy Authority, Springfields (England).
POTENTIAL APPLICATIONS OF FLUIDICS IN NUCLEAR PLANT
J. Grant and J. Wright 1967 10 p refs Presented at the 2d Cranfield Fluidics Conf., Cambridge, England, 3–5 Jan. 1967 Paper K2
CFSTI: HC $3.00/MF $0.65

Problems associated with reactor cores, such as access to core instruments and the high cost of penetration for control leads and instruments, are considered. The most severe instrumentation problem is described as that in which each coolant channel of a reactor is to be monitored individually, when a multiplicity of monitoring instruments, signal or control leads is required and where the pressure vessel must be breached with holes to provide access for the leads. Fluidics multiplexing allows a number of signal sources to be switched one at a time into a single route, thus reducing system complexity after the multiplexing point. As an example of multiplexing, the problem of measuring 256 coolant channel temperatures that would normally be monitored by 256 thermocouples is considered. To reduce the number of thermocouples fluid sampling rings, which are analogous to the electronic ring counter, would be constructed. Another important application of fluidics in reactors occurs where reversal of flow may cause damage. Fracture of a coolant pipe is used as an example. S.P.

N67-21116# Slovak Academy of Sciences, Bratislava (Czechoslovakia). Inst. of Technical Cybernetics.
PNEUMATIC DIGITAL OPTIMIZING DEVICE
M. Sevcik 1967 8 p refs Presented at the 2d Cranfield Fluidics Conf., Cambridge, England, 3–5 Jan. 1967 Paper K1
CFSTI: HC $3.00/MF $0.65

A one-channel digital step optimizing device is described that is designed for controlling processes with large time constants and composed of pneumatic logical elements. A concise description is given of the operation principle of the optimizing device and its pneumatic logical elements. The device is composed of circuits for transforming the digital information, circuits for information processing proper and a programming block which controls the single operations. The functioning of these circuits, their technical properties, the block scheme of the optimizing device, and the logical schemes of the shift register and the comparing unit are described. The operation of the optimizing device has been checked by means of a pneumatic model of the control circuit. Author

N67-21117# Officine di Villar Perosa, S.P.A., Turin (Italy).
THE AF-RELAY—SOME APPLICATIONS TO AUTOMATIC CONTROL SYSTEMS
A. Abbate Daga 1967 22 p refs Presented at the 2d Cranfield Fluidics Conf., Cambridge, England, 3–5 Jan. 1967 Paper J3
CFSTI: HC $3.00/MF $0.65

After some short comments on the role of fluidics in instrumentation and automatic control, the behaviour of a specific fluidic component, the AF-relay, is analyzed with respect to its functions such as an adjustable-trigger-point relay, proximity switch, and oscillator. A particular fluidic system is then described which provides, in given sequences, acoustical and optical alarm signals in much the same way as the electronic alarm annunciators that have come into wide usage in chemical process controls. Author

N67-21118# Queens Univ., Belfast (Northern Ireland).
SOME CONSIDERATIONS IN THE DEVELOPMENT AND OPERATION OF FLUIDIC DEVICES
R. F. Boucher 1967 8 p refs Presented at the 2d Cranfield Fluidics Conf., Cambridge, England, 3–5 Jan. 1967 Paper B7
CFSTI: HC $3.00/MF $0.65

The ratio Reynolds number/Mach is suggested as a convenient similarity parameter for use along with Reynolds number when

the effects of both compressibility and viscosity are important. Experimental evidence is presented which indicates the marked effect of secondary flows on both smooth and roughened cover plates confining a reattaching jet and leads to an expression for the variation of the lower minimum Reynolds number with aspect ratio. Temperature variations and interconnecting lines are considered briefly. Author

N67-21119# Birmingham Univ. (England).
EXPERIMENTS WITH AND AND EXCLUSIVE-OR PASSIVE ELEMENTS
G. A. Parker and B. Jones 1967 23 p refs Presented at the 2d Cranfield Fluidics Conf., Cambridge, England, 3–5 Jan. 1967 Paper C4
CFSTI: HC $3.00/MF $0.65

The passive momentum interaction Half Adder is discussed and both static and dynamic tests are presented for two different configurations with side vents. Due to difficulties in generating the EXCLUSIVE-OR function in this element, further investigations are confined to separate AND and EXCLUSIVE-OR logic elements. It is concluded that the AND element may be comparatively easily designed to provide good static and dynamic characteristics and the EXCLUSIVE-OR configurations tested show a substantial improvement over the Half Adder design. A combination of wall attachment and momentum effects seem the most promising approach for future developments. Author

N67-21120 Societe Bertin et Cie, Plaisir (France).
THE CURVED WALL EFFECT
M. Kadosch 1967 12 p refs Presented at the 2d Cranfield Fluidics Conf., Cambridge, England, 3–5 Jan. 1967 Paper A4
CFSTI: $3.00

The curved wall effect or deflection of a jet of width and Reynolds number attached to a convex wall of radius is calculated as an effect of the separation of the boundary layer along the wall. Formulae are given both for laminar and turbulent boundary layers, in agreement with experimental results, although these are incomplete. Theory indicates an influence of the Reynolds number and predicts that the curved wall effect should disappear in the laminar case. Author

N67-21121 Strathclyde Univ., Glasgow (Scotland).
THE SWITCHING OF SUPERSONIC GAS JETS BY ATMOSPHERIC VENTING
R. V. Thompson 5 Jan. 1967 14 p refs Presented at the 2d Cranfield Fluidics Conf., Cambridge, Engl., 3–5 Jan. 1967
(A5) CFSTI: $3.00

The phenomenon of boundary layer separation is used to advantage in the operation of a high pressure, bistable, fluid bistable, fluid switch. Jets of air expanded through a non adapted, convergent–divergent, two dimensional duct at pressure ratios in excess of critical, can be encouraged to change their flow vector by the transverse introduction of further air at atmospheric pressure via strategically positioned control ports. The transverse to main thrust gain is considerable; of the order of 25 per cent for a control to main flow power ratio approaching zero. The positions of separation and reattachment of the main jet have been determined experimentally by the Schlieren process and verified by pressure tappings along the flow boundaries. An indication of the results so obtained are included in the text. Of prime interest are the suggested modes of operation, i.e. pressure feedback in the boundary layer and the pinpointing of separation and reattachment points, each disagreeing with generally accepted concepts. Author

N67-21122# Siemens-Schuckertwerke A. G., Munich (West Germany).
COUNTERS WITH BISTABLE FLUID ELEMENTS
K. Bantle 5 Jan. 1967 14 p refs Presented at the 2d Cranfield Fluidics Conf., Cambridge, Engl., 3–5 Jan. 1967
(H5) CFSTI: HC $3.00/MF $0.65

In the same way as bistable storage elements obeying other physical principles, so bistable fluid elements can be used for setting up counter circuits. The properties of some fluid mechanical counter circuits are discussed, a high stability counter stage for varying set-pulse lengths is described, and practical results are given. Author

N67-21123# British Telecommunications, Research, Ltd., Taplow (England). Plessey Electronics Group.
A METHOD OF USING WALL ATTACHMENT DEVICES IN AN ULTRASENSITIVE MODE
V. J. Chadwick 5 Jan. 1967 11 p ref Presented at the 2d Cranfield Fluidics Conf., Cambridge, Engl., 3–5 Jan. 1967 Sponsored by the Min. of Technol.
(B1) CFSTI: HC $3.00/MF $0.65

A method is described of increasing the effective sensitivity of a bistable device by using a pulsed power supply. Some results of experimental investigations of the method are discussed. Applications including a sensitive pulse detector, a latching AND gate, a shift register stage, and a pulse divider are given. Author

N67-21124# Giaettli (H. H.), Kuessnacht (Switzerland).
MOVING PART VERSUS NON-MOVING PART ELEMENTS
H. H. Giaettli 5 Jan. 1967 9 p Presented at the 2d Cranfield Fluidics Conf., Cambridge, Engl., 3–5 Jan. 1967
(G1) CFSTI: HC $3.00/MF $0.65

Moving and nonmoving part devices are compared with respect to reliability, speed of operation, size, and power requirements. Wall interaction elements and spool valves are discussed. It is noted that the performance of moving part elements does not rely on the Reynolds number in a qualitative way, that the quantitative effects are unique in controlling flow rates down to zero, and that there is more freedom as to the choice of supply pressure than in the case of nonmoving elements. It is concluded that as yet there is no decisive choice between moving and nonmoving parts, and that the best type of element or combination must be chosen according to the tasks to be performed. N.E.N.

N67-21125# National Engineering Lab., Glasgow.
A FLUIDIC ABSOLUTE MEASURING SYSTEM
R. Sharp, R. MacLean, and A. McClintock 5 Jan. 1967 11 p refs Presented at the 2d Cranfield Fluidics Conf., Cambridge, Engl., 3–5 Jan. 1967
(E3) CFSTI: HC $3.00/MF $0.65

The fluidic measuring system described is capable of linear or angular indication. Resolution is 0.001 inch with a repeatability of 0.00025 inch. The finest scale used is 100 lines/inch. Both scale and reading head are robust and cheap to produce. The working gap between scale and head is greater than 0.006 inch and is not critical. Author

N67-21126# Birmingham Univ. (England) Dept. of Mechanical Engineering.
A METHOD OF CALCULATING THE WALL PRESSURE DISTRIBUTION IN A TURBULENT REATTACHMENT BUBBLE
N. S. Jones, K. Foster, and D. G. Mitchell 5 Jan. 1967 15 p refs Presented at the 2d Cranfield Fluidics Conf., Cambridge, Engl., 3–5 Jan. 1967 Supported by the Sci. Res. Council
(A3) CFSTI: HC $3.00/MF $0.65

A method is given for calculating the wall pressure distribution in a turbulent reattachment bubble. The bubble is split up into a

large number of small control volumes within the reattaching streamline, and by assuming the shear stress along this streamline to be the same as that of a free jet, and also by assuming certain velocity profiles within the bubble, the momentum exchange across each volume may be evaluated. Only the experimental pressure in the first control volume close to the nozzle is required for the step by step calculation to proceed. The results are compared with experiment, and some experimental variation of bubble length with aspect ratio is reported which is unexpected. Author

N67-21127# English Electric Co., Ltd., Whetstone (England). Mechanical Engineering Lab.

CHARACTERISTICS OF PROPORTIONAL FLUIDIC AMPLIFIERS

A. McCabe and D. L. Hughes 5 Jan. 1967 16 p refs Presented at the 2d Cranfield Fluidics Conf., Cambridge, Engl., 3–5 Jan. 1967

(C5) CFSTI: HC $3.00/MF $0.65

The initial results of flow visualization in the interaction region of a submerged water operated proportional amplifier model are presented. Static and dynamic characteristics for a small air operated amplifier are given and the effects of some changes in geometry discussed. Author

N67-21128# Climax-France, Neuilly-sur-Seine.

NEW APPROACH AND RECENT DEVELOPMENTS IN PISTON FLUID LOGIC AS APPLIED TO GENERAL AUTOMATION

D. Bouteille 5 Jan. 1967 12 p Presented at the 2d Cranfield Fluidics Conf., Cambridge, Engl., 3–5 Jan. 1967

(D3) CFSTI: HC $3.00/MF $0.65

Logic methods are developed to make use of conventional piston valves for applications in general automation. By using the many logic possibilities of 3-way and 4-way valves, it is shown how few valves are needed for a given problem. Another quality of piston valves as used in logic techniques is to give a flipflop whose state cannot be lost by a temporary lack of power. Also, the general tendency to miniaturize pneumatic equipment has produced small, cheap and reliable piston valves with sufficient air flows and pressures for direct pneumatic control of power valves. Author

N67-21129# Bristol Univ. (England).

INVESTIGATION OF THE SWITCHING MECHANISM IN A LARGE SCALE MODEL OF A TURBULENT REATTACHMENT AMPLIFIER

P. A. Lush 5 Jan. 1967 16 p refs Presented at the 2d Cranfield Fluidics Conf., Cambridge, Engl., 3–5 Jan. 1967

(A1) CFSTI: HC $3.00/MF $0.65

A theory based on turbulent jet entrainment properties and the assumption of quasi-steady flow is presented for the prediction of switching times in a turbulent reattachment fluid amplifier. The predictions are compared with experimental results obtained by measuring pressures during the switching action. The model used in the experiments had a throat width of 1.0 in. (25 mm) and a main jet aspect ratio of 1.0. The tests were carried out using air and with a main jet Reynolds number of 9×10^4. The agreement between the theoretical and experimental results was generally good and so the theory provides a basis for further theoretical work in this field. Author

N67-21130# British Hydromechanics Research Association, Cranfield (England).

THE APPLICATION OF FLUIDICS TO THE DETECTION OF BURST FUEL ELEMENTS IN NUCLEAR REACTORS

M. J. Fisher and A. Thomson 5 Jan. 1967 16 p refs Presented at the 2d Cranfield Fluidics Conf., Cambridge, Engl., 3–5 Jan. 1967 Supported by United Kingdom Atomic Energy Authority

(K5) CFSTI: HC $3.00/MF $0.65

The development of wall attachment amplifiers as fluid switches for use in a fluid sampling system for locating burst fuel elements is discussed. The primary concern in this application is that a fluid sample is not contaminated or diluted by fluid from another source. The output characteristics of various amplifiers have been examined with this in mind. Changes due to entrained gas and input flow variations have also been studied. Some of the problems encountered in connecting these amplifiers in a ring counter circuit are also described. Author

N67-21131# College of Aeronautics, Cranfield (England).

THE DESIGN AND CONSTRUCTION OF A PURE FLUID FOUR BIT BINARY COMPARATOR

I. Aviv, R. E. Bidgood, and S. Ramanathan 5 Jan. 1967 24 p refs Presented at the 2d Cranfield Fluidics Conf., Cambridge, Engl., 3–5 Jan. 1967

(H6) CFSTI: HC $3.00/MF $0.65

A pure fluid binary comparator has been constructed giving 4-bit comparison. Output signals are obtained for $A<B$, $A>B$ and equivalents. Details are given of input and output conditions to obtain an overall comparison frequency in excess of 600 cps. A unique method of signal inhibition is utilized which reduces the complexity of the circuit; only four active units are required for complete comparison. Author

N67-21132# Research Inst. for Mathematical Machines, Prague (Czechoslovakia).

SOME APPLICATIONS OF FLUID LOGIC ELEMENTS IN DEVICES FOR DRIVING RECORDING TAPE

Stanislav Jura 5 Jan. 1967 7 p refs Presented at the 2d Cranfield Fluidics Conf., Cambridge, Engl., 3–5 Jan. 1967

(J1) CFSTI: HC $3.00/MF $0.65

The possibilities and advantages of the use of fluid logic elements in devices for the drive of a recording tape are considered. The start–stop systems, stepping devices, and rewind equipment, based on pneumatic and electropneumatic principles respectively, are discussed. Author

N67-21140 British Telecommunications Research, Ltd., Taplow (England). Plessey Electronics Group.

AN EMPIRICAL EXPRESSION FOR THE RESISTANCE OF SMALL BORE TUBES TO TURBULENT FLOW

G. E. Davies 5 Jan. 1967 24 p refs Presented at the 2d Cranfield Fluidics Conf., Cambridge, Engl., 3–5 Jan. 1967

(D2) CFSTI: $3.00

An attempt to determine the resistance of small bore tubes to the turbulent flow of a compressible fluid is described. A theoretical expression was developed in terms of mass flow and total head, containing an unknown nondimensional factor which was then determined from experimental measurements on P.V.C. tubes. This factor is shown to be a function of the Reynolds' number, and by comparison with existing test results for large bore water mains is shown to be consistent with a slightly rough internal surface finish. Low speed flow conditions are assumed throughout. Author

N67-21158 Aeronautical Research Council (Gt. Brit.)

THE PERFORMANCE OF CONICAL CONVERGENT-DIVERGENT NOZZLES OF AREA RATIO 2.44 AND 2.14 IN EXTERNAL FLOW

G. T. Golesworthy, J. B. Roberts, and C. Overy London, HMSO, 1966 28 p refs Supersedes NGTE-M-372; ARC-26494; see X65-12967
(ARC-CP-893; NGTE-M-372; ARC-26494) CFSTI: $3.00

Two model internal-expansion propelling nozzles with conical divergence of 10° semi-angle, area ratios 2.44 and 2.14 (design pressure ratios 15 and 12), parallel afterbodies and thin annular bases, have been tested in external flow over the range of Mach No. 0.7 to 2.25. Measurements have been made of nozzle base pressure, and thrust efficiencies derived with reference to both ambient and base pressure levels. It is found that, in supersonic external flow, with complete expansion of nozzle internal flow to ambient pressure, the value of base pressure ratio is independent of nozzle design pressure ratio, provided the base thickness is unchanged. For a given overall operating pressure ratio, again with constant base thickness, the effect of decreasing nozzle design pressure ratio is to raise base pressure ratio. In subsonic external flow, for a given overall operating pressure ratio, base pressure ratio can be independent of nozzle design pressure ratio. Author

N67-21159 Aeronautical Research Council (Gt. Brit.)
AN EXPERIMENTAL INVESTIGATION OF THE FLOW THROUGH INCLINED CIRCULAR TUBES AT A MACH NUMBER OF 4.0
P. L. Roe London, HMSO, 1966 47 p refs Supersedes RAE-TR-65110; ARC-27183; see N66-19487
(ARC-CP-884; RAE-TR-65110; ARC-27183) CFSTI: $3.00

Pressure plotting experiments have been performed on the internal flow through inclined circular tubes at M=4, and the results used to investigate both the nature of the flow and the internal forces. It is intended to apply the results to the wind tunnel testing of models with nacelles. Linear theory calculations have been made and the predicted forces are in good agreement with experimental values, provided the ducts are short. Author

N67-21174*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
THE MAIN SECTION OF AXISYMMETRICAL JETS OF AN INCOMPRESSIBLE FLUID FLOWING FROM AN APERTURE OF FINITE SIZE INTO A CO-AXIAL UNIFORM OF THE SAME FLUID
V. V. Pavlovskiy Redstone Arsenal, Ala., Redstone Sci. Inform. Center, 29 Nov. 1966 20 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Mekhan. (Moscow), No. 6, 1965 p 34–41
(NASA-TM-X-59490; RSIC-612) CFSTI: HC $3.00/MF $0.65 CSCL 20D

The existing approximate solutions of this problem are based on the use of predetermined velocity profiles in transverse sections of the flow. This paper proves that a solution can also be obtained by strict integration of equations dealing with the boundary layer. Author

N67-21178 Douglas Aircraft Co., Inc., Santa Monica, Calif. Missile and Space Systems Div.
UNSTEADY PISTON-GENERATED FLOWS IN GASKINETICS
K. Toba Feb. 1967 53 p refs
(DAC-59160) CFSTI: HC $3.00

An analysis of piston-generated motion in a rarefied gas is treated as an initial value problem or an initial and boundary value problem of the collisionless Boltzmann equation. The solution for a plane piston accelerated impulsively serves as a basis for studying arbitrary finite acceleration problems. Special attention is placed on the small amplitude sinusoidal oscillation of a plane piston since it can be regarded as the highly rarefied limit of the generation and propagation of sound in a gas where the Knudsen number based on the distance from the piston is large. The present work seeks to clarify and extend previous theoretical investigations with emphasis on the role played by gas-surface interaction. The resulting propagation properties such as dispersion and attenuation rate are in qualitative agreement with experimental values and previous theoretical predictions. However, the dependence of these properties on the molecule-surface interaction is found to be much more involved than suggested by earlier investigators, consequently leading to substantial quantitative disagreement between the present results on the propagation properties and those predicted previously. Author

N67-21182# Aeronautical Research Council (Gt. Brit.)
ON THE INTERACTION OF THE TRANSMITTED SHOCK WITH THE BOUNDARY LAYER IN A SHOCK TUBE USING ARGON AS A TEST GAS
L. Davies and K. Bridgman 1966 26 p refs Supersedes NPL-AERO-1032; ARC-26221; see X66-14803
(ARC-CP-879; NPL-AERO-1032; ARC-27221) CFSTI: HC $3.00/MF $0.65

A shock shock-tube investigation of the interaction of the transmitted shock with the boundary layer has been made using argon as test gas and helium as driver gas. The transmitted shock arises from the interaction of the contact surface with the shock reflected from the end plate. It is shown that bifurcation can occur under certain conditions and the relevance of this to the cooling of the hot gas near the end plate is discussed. Author

N67-21183# Aeronautical Research Council (Gt. Brit.)
A NOTE ON SKIN-FRICTION LAWS FOR THE INCOMPRESSIBLE TURBULENT BOUNDARY LAYER
J. F. Nash 1966 14 p refs Supersedes NPL-AERO-1135, ARC-26632; see X66-10431
(ARC-CP-862; NPL-AERO-1135; ARC-26632) CFSTI: HC $3.00/MF $0.65

A comparison is made of four skin-friction laws in current use—viz., those of Ludwieg and Tillmann, Rotta, Coles and Thompson. A proposal is also made for a modified law which may be extrapolated towards separation more confidently than is possible with existing laws. Author

N67-21184# Aeronautical Research Council (Gt. Brit.)
DETERMINATION OF SKIN FRICTION, SEPARATION AND TRANSITION WITH A THIN FILM-HEATED ELEMENT
B. J. Bellhouse and D. L. Schultz 1966 18 p refs Supersedes ARC-25660; see X65-15263
(ARC-R&M-3445; ARC-25660) CFSTI: HC $3.00/MF $0.65

A thin film heated element is used to measure skin friction in laminar flow, and to locate transition and separation regions, on a circular cylinder. A small removable element, applicable to any model shape, is described, and is used to measure skin friction in laminar and turbulent boundary layers. Author

N67-21193 Aeronautical Research Council (Gt. Brit.)
A NOTE ON THE TURBULENT UNIFORM-PROPERTY HYDRODYNAMIC BOUNDARY LAYER ON A SMOOTH IMPERMEABLE WALL; COMPARISONS OF THEORY WITH EXPERIMENT
M. P. Escudier and D. B. Spalding (Imperial College) 1966 26 p refs Supersedes ARC-27302; see X66-14987
(ARC-CP-875; ARC-27302) CFSTI: HC $3.00/MF $0.65

Experimental data are compared with generalizations deduced from earlier data, in respect of the mixing-length distribution and

dissipation integral; the agreement is satisfactory. Also presented is a preliminary theory of boundary-layer development employing an empirical formula for the relation between the dissipation integral, the drag coefficient and the shape factor; the integral momentum and kinetic-energy equations are solved numerically. The predictions of this theory are compared, in respect of shape factor, with the experiments and those of many other experimenters. The agreement is satisfactory except for large adverse pressure gradient, where divergences of both positive and negative sign are observed; the reasons for these divergences are discussed. Author

N67-21194 Aeronautical Research Council (Gt. Brit.)
THE USE OF AIR INJECTION TO PREVENT SEPARATION OF THE TURBULENT BOUNDARY LAYER IN SUPERSONIC FLOW
D. J. Peake 1966 53 p refs Supersedes NGTE-R-256; see X64-12578
(ARC-CP-890; NGTE-R-256) CFSTI: $3.00

An experiment has shown that a wall jet is able to prevent the separation of a turbulent boundary layer in a supersonic flow having a large pressure rise. The experiment was conducted with a mainstream Mach number of 1.8 upstream of the pressure rise at a Reynolds number of 4 million. A practical application of the work could be to supersonic air intakes. The potential performance of such an intake with injection boundary layer control appears to be about the same as that of an intake using suction control, but some of the design problems might be easier. Author

N67-21277 Serck Radiators, Ltd., Birmingham (England).
HEAVY CURRENT FLUIDIC DEVICES
G. A. Montgomerie and T. J. Floyd [1967] 12 p ref Presented at the 3d Cranfield Fluidics Conf., Cambridge, Mass., 3–5 Jan. 1967
(K4) CFSTI: HC $3.00

An automatic self-cleaning filter that contains no moving parts is used to illustrate the principles and applications of heavy current fluidic devices. A developmental history of the self-cleaning fluidic filter system is included; and results are tabulated for several variations in the loop diverter configuration that increase the persistence of the loop as a whole without producing leakage into the back flow channel. Illustrations are included of systems with simulated filter elements, with dirt collection provisions, with baffling added to collect pot, and with separate collecting pots. A reclamation vortex is shown, as are various modifications of flow passage. The resulting breadboard model for the fluidic filter system can be made into a feasible production model by placing a number of complex flow passages in a competitive envelope without interfering with the parameters affecting system operation. M.W.R.

N67-21278 Bristol Univ. (England).
ANALYSIS OF TIME DEPENDENT JET ATTACHMENT PROCESSES AND COMPARISON WITH EXPERIMENT
R. A. Sawyer [1967] 12 p refs Presented at the 2d Cranfield Fluidics Conf., Cambridge, Engl., 3–5 Jan. 1967
(A2) CFSTI: $3.00

The attachment time of a thin, two-dimensional, turbulent jet to an adjacent parallel flat plate is calculated using a quasi-steady analysis. Comparison with experiment shows that the theory gives good predictions of attachment times and that the quasi-steady assumption is justified. On the basis of the analysis, neutral stability curves were constructed that indicated a choice of entrainment parameter to account for reduced entrainment along the inner edge of the curved jet. A method is presented for predicting attachment behavior of known wall shapes and for designing wall profiles of predetermined attachment characteristics. Author

N67-21279# Birmingham Univ. (England).
FLUIDIC CIRCUITS USED IN A DRILLING SEQUENCE CONTROL
K. Foster, D. G. Mitchell, and D. A. Retallick [1967] 24 p refs Presented at the 2d Cranfield Fluidics Conf., Cambridge, Mass., 3–5 Jan. 1967
(H4) CFSTI: HC $3.00/MF $0.65

A simple drilling sequence control with positioning in one axis by means of stops is described. The system incorporates principles applicable to larger and more complex systems; e.g. information is introduced into the machine by means of a card reader, and a feedback system is used for positive identification of stops. A description of the control circuit is given; and details are included of the development of a ring counter, binary counting stage and a comparator. Author

N67-21341# Oregon Univ., Eugene. Physics Dept.
BOLTZMANN EQUATION APPROACH TO TRANSPORT PHENOMENA
Shigeji Fujita Oct. 1966 49 p refs
(Contract Nonr-2771(05))
(TR-9; AD-642399) CFSTI: HC $3.00/MF $0.65

Contents: Mechanical evolution equation for the one-body distribution function; Connected-diagram analysis; Non-Markoffian evolution equation; The effect of the initial particle correlation; Self-diffusion constant and electrical conductivity in a plasma; Density expansion of a transport coefficient. TAB

N67-21360# University of Southern Calif., Los Angeles. School of Engineering.
AN EXPERIMENTAL STUDY OF HYPERSONIC RAREFIED FLOW OVER A 10° CONE
Roy Scott Hickman Sep. 1966 28 p refs Presented at the 5th Intern. Symp. on Rarefied Gas Dyn., Oxford, 4–8 Jul. 1966
(Grant AF-AFOSR-697-66)
(USCAE-101; AFOSR-66-2410; AD-643272) CFSTI: HC $3.00/MF $0.65

The local values of temperature, density, and impact pressure were measured for flow over a 10 degree total angle cone aligned with a Mach 9.4, 300K stagnation temperature, low density flow of nitrogen. The density and temperature were measured using electron beam techniques. The flow was produced in a conical nozzle which produced a useful inviscid core of approximately 2 inches dia. The entire flow field exhibits strong interaction or rarefied phenomena. The flow field appears to approach continuum behavior as it proceeds downstream, however, near the cone tip the presence of the hot surface affects the external density gradient or shock. Because of the presence of the body, the density ratio across the apparent shock does not satisfy the Rankine-Hugoniot conditions. The local impact pressure profiles normalized to free stream impact pressure are similar in shape to the local density data. The local temperature data indicates that the gradient is highest near the wall close to the tip and decreases with distance from the model tip. The resulting temperature jump at the wall is of order of magnitude of 200K and decreasing with increasing distance from the tip. Author (TAB)

N67-21364# General Electric Co., Philadelphia, Pa. Missile and Space Div.
A DISCRETE ORDINATE TECHNIQUE FOR THE NON-LINEAR BOLTZMANN EQUATION WITH APPLICATION TO PSEUDO-SHOCK RELAXATION

M. Wachman and B. B. Hamel Dec. 1966 36 p refs Presented at the 5th Intern. Rarefied Gas Dyn. Symp., Oxford, Jul. 1966
(Contract AF 49(638)-1638)
(AFOSR-66-1923; R66SD48; AD-644490) CFSTI: HC $3.00/MF $0.65

A numerical method for the solution of the non-linear Boltzmann equation for hard sphere molecules is developed, in which approximations are made only in the sense of numerical truncations. This is an extension of the work on the linearized Boltzmann equation previously reported in AD-604 749. The distribution function is evaluated at a three-dimensional grid of distinct velocity points. A five fold Gaussian quadrature is performed to evaluate the derivatives at these points. The distribution function is then evaluated at t sub o + delta t by solving a system of first order ordinary differential equations. In the non-linear case the grid is no longer closed, and the procedure to circumvent the difficulty is described. In the present paper, this technique is applied to the problem of non-linear, homogeneous, pseudo-shock relaxation. Author (TAB)

N67-21377# Brown Univ., Providence, R. I. Div. of Applied Mathematics.
VISCOMETRIC FLOWS OF NON-NEWTONIAN FLUIDS
Ronald S. Rivlin Nov. 1966 26 p refs
(Contract Nonr-562(40))
(TR-19; AD-644215) CFSTI: HC $3.00/MF $0.65

A simple analysis of certain viscometric flows of incompressible, isotropic, non-Newtonian fluids is given. In contrast to the procedure used in the original calculations, the method employed in the present paper involves only the most elementary concepts of continuum mechanics. Author (TAB)

N67-21417 National Aerospace Lab., Tokyo (Japan).
SOME INVESTIGATIONS ON INVISCID BOUNDARY LAYER OF MAGNETOHYDRODYNAMICS
Kenji Inouye 1966 21 p refs In JAPANESE; ENGLISH summary
(NAL-TR-110) CFSTI: $3.00

Inviscid magnetohydrodynamic boundary layer in a steady, two-dimensional, aligned-fields flow of highly conducting incompressible fluid is considered. A parameter, pressure number, which is equal to the ratio of magnetic pressure to dynamic pressure appears in this problem. By employing a coordinate tranformation analogous to one in conventional viscous boundary layer problems, a similar solution for the case of a weak magnetic field and an arbitrary outer flow is obtained. The solutions by series expansion are compared with the solutions by direct integration. Nonexistence of the solution for the case of pressure number greater than unity is shown. Author

N67-21420# Aeronautical Research Council (Gt. Brit.)
TURBULENT BOUNDARY LAYER THEORY AND ITS APPLICATION TO BLADE PROFILE DESIGN
D. J. L. Smith 1966 75 p refs Supersedes NGTE-M-395; ARC-26961; see X65-18307
(ARC-CP-868; NGTE-M-375; ARC-26961) CFSTI: HC $3.00/MF $0.65

Five methods of predicting the impressible, two-dimensional turbulent boundary layer have been applied to flow conditions considered to occur over the suction surface of turbo machine blades and the measure of agreement between the separation criteria and boundary layer characteristics assessed. To assist in the design of blade profiles, envelopes of suction surface velocity distribution have been constructed to give separation at the trailing edge; these are considered to be conservatively based. Author

N67-21440# Naval Ordnance Lab., White Oak, Md.
FORMULATION OF THE COMPLETE EQUATIONS OF BOUNDARY LAYER STABILITY WITH MASS TRANSFER Final Report
John O. Powers 24 Oct. 1966 36 p refs
(NOLTR-66-187; AD-644532) CFSTI: HC $3.00/MF $0.65

The stability theory of laminar boundary layers in response to infinitesimal disturbances was re-examined for the case of a binary mixture with foreign gas injection. Because of the inherent limitations of the asymptotic stability calculation procedures, an approach was taken which utilizes the complete equation system. Such an approach is described and the resulting system of equations is presented in a manner suitable for numerical evaluation. Author (TAB)

N67-21472# California Univ., Berkeley. Lawrence Radiation Lab.
PERMEATION OF MONATOMIC GASES THROUGH ALUMINUM OXIDE
Richard Hugh Edwards (M.S. Thesis) 25 Aug. 1966 47 p refs
(Contract W-7405-ENG-48)
(UCRL-17083) CFSTI: HC $3.00/MF $0.65

Permeation studies of He and Ar through commercial Al_2O_3 bodies were made. Permeation occurred through thin diamond ground cylindrical sections. Flow rates through the specimen were measured by a residual gas analyzer. He and Ar pressures of 380 to 1010 mm Hg at 783 to 1539°C were used for specimens containing 99.5 and 94 wt % Al_2O_3. Permeation constants and activation energies were calculated. He permeation constants up to 1.4×10^{11} and 8.1×10^{9} atoms/sec cm atm and average activation energies of 13.6±2.3 and 13±1.7 kcal/mole were found for the 94 and 99.5% Al_2O_3 ceramics, respectively. No Ar flow through the specimens was detected at pressures up to 1010 mm Hg. The limit of detectability of the apparatus fixes k values for Ar permeation at less than 2×10^{9} atoms/sec cm atm in the temperature range studied. He diffusion along continuous glassy paths was thought to be responsible for flow through both alumina bodies. Author (NSA)

N67-21507# Atomic Energy Commission, New York. Health and Safety Lab.
PRESSURE DROP ACROSS SHARP END CAPILLARY TUBES
David Rimberg Nov. 1966 86 p refs
(HASL-180) CFSTI: HC $3.00/MF $0.65

In fluid flow problems it is often necessary to evaluate the overall pressure drop across sharp end tubes. For laminar flow, Poiseuille's Law is used as an approximation of the actual pressure drop. For accurate work the following three corrections must be applied: the difference in pressure between the still inlet fluid and the moving fluid within the tube has to be accounted for; the effect of a nonuniform velocity distribution across the pipe will contribute to a pressure loss; and the losses due to end effects must also be included. An equation was developed which not only includes these corrections for pressure drop but also the loss associated with frictional resistance within the tube. By allowing air to flow through many capillary tubes of various lengths and diameters, with Reynolds numbers less than 2100, this new equation was tested. The pressure drop across the capillary was accurately determined with special experimental equipment. This pressure drop was then compared to the pressure drop obtained analytically. The result of this comparison proved that for laminar flow the aforementioned corrections must be considered in any precise determination of the pressure difference which occurs with abrupt changes in cross-section. Author (NSA)

N67-21607# Sandia Corp., Albuquerque, N. Mex.
MICROBIOLOGICAL STUDIES OF LAMINAR FLOW ROOMS
W. J. Whitfield Sep. 1966 18 p refs Presented at the Ann. Conv. of the Parenteral Drug Assoc., Inc., New York, 2 Nov. 1966
(Contract AT(29-1)-789)
(SC-DC-66-2277; CONF-661106-1) CFSTI: HC $3.00/MF $0.65

The laminar flow concept and how laminar flow devices control airborne particles are described briefly. Data are shown for total particle (viable and nonviable) counts for various types of laminar flow systems. A review is made of various types of microbiological studies conducted in laminar flow rooms, and preliminary results are presented for a laminar flow hospital operating room. Author (NSA)

N67-21622# California Univ., Livermore. Lawrence Radiation Lab.
TWO-PHASE PRESSURE DROP: LITERATURE SURVEY AND CORRELATION ANALYSIS
Raymond D. Caughron (M.S. Thesis) 1 Sep. 1966 89 p refs
(Contract W-7405-ENG-48)
(UCRL-50123) CFSTI: HC $3.00/MF $0.65

Methods for predicting pressure drops in two-phase flow systems were investigated. A literature survey covers the historical development and current status of the subject. Flow classification, technical terms, important equations, and interrelationships among variables pertinent to the study of two-phase flow were reviewed. A general description of two-phase pressure drop is presented including the energy and momentum equations. Prediction methods were categorized according to method of approach (empirical, dimensional, similarity, mathematical analysis applied to simplified physical models, and approximation theory). Numerical examples were included to demonstrate the Dukler and Lockhart–Martinelli approaches. Comparison methods by Dukler, Anderson and Russell, and Hughmark with tables are included. Baker's chart and method of predicting two-phase flow regimes, experimental steam–water data, and computer subroutines for the Homogeneous and Lockhart–Martinelli methods are given in the appendices. Author (NSA)

N67-21651# General Electric Co., Schenectady, N. Y. Knolls Atomic Power Lab.
THEORETICAL ANALYSIS OF FLOW-INDUCED VIBRATION OF A BLADE SUSPENDED IN A FLOW CHANNEL
D. R. Miller and R. G. Kennison 26 May 1966 54 p refs
(Contract W-31-109-ENG-52)
(KAPL-M-6559) CFSTI: HC $3.00/MF $0.65

Theoretical analyses of two modes (translational motion and angular motion) of flow-induced vibration of a suspended blade are outlined. To enable a closed-form solution, it was assumed that there is no flow from one side of the blade to the other. The analyses show that under some conditions a self-excited vibration can occur, when the insertion of the blade into a narrow upstream section of the flow channel is less than a critical amount. The analyses also show that the flow rate must exceed a critical value for this vibration to occur. Theoretical results were in reasonable agreement with experimental observations, except for deviations attributable to flow around the edges of the blade. The latter effect makes the observed flow rate for inception of self-excited vibrations much higher than the theoretical value. Author (NSA)

N67-21704# Navy Mine Defense Lab., Panama City, Fla.
ACOUSTIC CAVITATION AND BUBBLE INSTABILITIES
Joseph E. Blue Dec. 1966 42 p refs
(RR-314; AD-644309) CFSTI: HC $3.00/MF $0.65

The nonlinear differential equation of undamped motion for a bubble under the influence of a sinusoidal pressure field in an infinite incompressible liquid is examined for instabilities by the small perturbation method. The purpose of the investigation is to experimentally determine if acoustic cavitation occurs at lower acoustic pressure at the predicted instability frequencies of the nonlinear equation for bubble motion. An acoustic cell with a plate glass top was designed and built in which bubbles were trapped against the underside of the horizontal glass. The effect of the glass boundary was calculated. The effect of the boundary changed one term in the nonlinear differential equation by a constant which lowered the resonant frequency of the bubble. The resonant frequency for an air bubble trapped against the glass of the acoustic cell was measured and found to be in close agreement with that predicted. Measurements also showed that for an air bubble in water acoustic cavitation will occur at lower acoustic pressures at the bubbles resonant frequency and possibly at the second harmonic. There was no indication of subharmonic effects for the air bubbles in water. Author (TAB)

N67-21705# General Electric Co., Philadelphia, Pa. Missile and Space Div.
EXACT SOLUTIONS TO THE NAVIER–STOKES EQUATIONS WITH CURL FREE CONVECTIVE ACCELERATIONS
Vivian O'Brien and Sheldon Weinbaum (APL) Sep. 1966 36 p refs
(R66SD61; AD-802095)

A general analysis in curvilinear streamline coordinates is developed in order to investigate systematically the behavior of all possible two-dimensional and axially-symmetric fluid motions with curl free convective accelerations that are exact solutions to the incompressible Navier–Stokes equation. The analysis includes: (1) all flows where the convective terms vanish, (2) irrotational flows, omega = 0, (3) Beltrami flows and (4) all other fluid motions that satisfy the kinematic constraint curl $V \times \omega = 0$. Specific solutions are referenced, derived or deduced by analogy with a related mechanical problem to give the reader a qualitative idea of the physical behavior of a class of motions. New exact solutions are presented for two-dimensional motions with cross flow and axially-symmetric motions with swirl. Author

N67-21709# University of Southern Calif., Los Angeles. Dept. of Aerospace Engineering.
DISTRIBUTION FUNCTION AND TEMPERATURES IN A MONATOMIC GAS UNDER STEADY EXPANSION INTO A VACUUM
Richard H. Edwards and Hsien K. Cheng Sep. 1966 22 p refs Presented at 5th Intern. Symp. on Rarefied Gas Dyn., Oxford, 4–8 Jul. 1966
(Grant AF-AFOSR-697-66)
(AFOSR-66-2409; USCAE-100; AD-643270) CFSTI: HC $3.00/MF $0.65

The distribution function for the spherical source is determined by integrating the B-G-K model equation, where the local temperature is determined by the moment equations under the hypersonic approximation. In the far field, the axial distribution is nearly Maxwellian. A free molecule limit exists, but does not define the lateral temperature and higher moments properly. The lateral temperature is determined by far field collisions, and is largely contained in the tail of the lateral distribution. A Mach number or a Reynolds number similarity in the distribution function is shown. Author (TAB)

N67-21743# Royal Aircraft Establishment, Farnborough (England).
BASIC EXPERIMENTS ON THE RE-ATTACHMENT OF A SUPERSONIC STREAM [EXPERIENCES FONDAMENTALES SUR LE RECOLLEMENT TURBULENT D'UN JET SUPERSONIQUE]

M. Sirieix, J. Miranda, and J. Delery Nov. 1966 38 p refs Transl. into ENGLISH from the French
(RAE-LIB-TRANS-1196) CFSTI: HC $3.00/MF $0.65

A survey is made of the basic data yielded by previous experiments on turbulent reattachment, and a detailed analysis of the recompression field from data provided by refined methods is presented. Various characteristics are brought out, mainly the existence of critical points and of a law of similarity in the evolution of wall pressures. An attempt has been made to acquire a more precise knowledge of the reattachment structure; interferometry methods have made it possible to obtain the evolution of boundary layer thicknesses during reattachment. Author

N67-21847# ARO, Inc., Arnold Air Force Station, Tenn.
INVESTIGATION OF THE EFFECT OF FLARE AND RAMP ANGLE ON THE UPSTREAM INFLUENCE OF LAMINAR AND TRANSITIONAL REATTACHING FLOWS FROM MACH 3 TO 7
J. Don Gray Arnold Eng. Develop. Center, Jan. 1967 71 p refs
(Contract AF 40(600)-1200)
(AEDC-TR-66-190; AD-645840) CFSTI: HC $3.00/MF $0.65

An experimental investigation of laminar- and transitional-flow separation induced by flares and ramps of different angles was conducted at Mach numbers 3, 5, and 7 over a broad Reynolds number range. Surface pressure distributions, schlieren and shadowgraph pictures, and the oil film technique were used to determine the effect of transition during flow reattachment on the scale of laminar separation. It is concluded that because transition was always triggered prematurely by the reattachment pressure gradient, small flow deflections (theta < or ~ 10 deg) are required when investigating laminar reattaching flows at similar test conditions. The scale of separation increased with Reynolds number increase, and the pressure distribution upstream of the flare was characterized by the absence of any lengthy plateau whenever the flow was laminar through the reattachment zone. Nose blunting reduced the extent of such separations. Author (TAB)

N67-21878# Oceanics, Inc., Plainview, N. Y.
A HYDRODYNAMIC THEORY FOR CAVITATING DELTA WING HYDROFOILS Final Technical Report, 1 Dec. 1963–30 Nov. 1966
Paul Kaplan, Theodore R. Goodman and C. C. Chen Dec. 1966 56 p refs
(Contract Nonr-4328(00))
(TR-67-33; AD-646269) CFSTI: HC $3.00/MF $0.65

The status of hydrodynamic theories is reviewed, and it is found that asymptotic results for limiting conditions of cavitation (i.e. large and small cavitation numbers) in earlier work by Tulin are incorrect. The mathematical problem of conical flow for cavitated delta wings of fairly wide apex angles is recast with a new closure condition replacing the previous condition of no source-like flow in a transverse plane. The results obtained for lift coefficient, for apex angles up to 60 degrees, as a function of angle of attack and cavitation number are compared with available experimental data. The comparison indicates good agreement of the new theory for delta wings with apex angles up to 45 degrees. Thus, differences in results obtained using different mathematical and physical models are delineated, together with information on the respective regions of validity by virtue of comparison with experimental data. Author (TAB)

13 GEOPHYSICS

Includes aeronomy; upper and lower atmosphere studies; oceanography; cartography; and geodesy. For related information see also: 20 Meteorology; 29 Space Radiation; and 30 Space Sciences.

N67-20389 Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
PHOTOCHEMICAL EQUILIBRIUM AND IONIC COMPOSITION OF THE UPPER LAYERS OF ATMOSPHERE
V. N. Konashenok *In its* Cosmic Res. 23 Jun. 1966 p 144–151 refs (See N67-20381 10-30) CFSTI: $3.00

The system of chemical and photochemical reactions that control the ionic composition of the atmosphere at altitudes of 150–300 km is studied. The conclusion drawn is that direct insertion of experimental data into the balance equation enables us, in some cases, to select the most effective processes from among the possible ones. Author

N67-20392 Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ON THE TOTAL QUANTITY OF NEUTRAL HYDROGEN IN THE EARTH'S UPPER ATMOSPHERE
V. G. Kurt *In its* Cosmic Res. 23 Jun. 1966 p 180–188 refs (See N67-20381 10-30) CFSTI: HC $3.00

The approximate scattering theory was used to determine the distribution of hydrogen in the earth's ionosphere from observations of solar L_α radiation resonance scattering. Using this method, the albedo (ratio of intensities of the scattered radiation at the zenith and nadir) is constructed as the function of altitude for various values of the total optical thickness τ_0. It was found that best agreement between theory and experiment is obtained for $\tau_0=7$ when the sun is 40° below the horizon; and for $\tau_0=12$ when the sun is 75° below the horizon. S.C.W.

N67-20400 Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
GEOMAGNETIC FIELD STRENGTH COMPONENTS IN THE SOLAR-ECLIPTIC COORDINATE SYSTEM
A. D. Shevnin *In its* Cosmic Res. 23 Jun. 1966 p 268–272 refs (See N67-20381 10-30) CFSTI: $3.00

Described is a method which employs the use of spherical trignometric formulas or Euler angles for calculating geomagnetic field strength components in the solar-ecliptic coordinate system. S.C.W.

N67-20401# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
RADIOACTIVITY OF THE KOSMOS 3 SATELLITE AFTER THE EXPLOSION OF 9 JULY 1962
A. D. Bolyunova *In its* Cosmic Res. 23 Jun. 1966 p 273–278 refs (See N67-20381 10-30) CFSTI: HC $3.00/MF $0.65

Discussed are results of Cosmos III satellite gieger counter measurements of radiation particles formed in the Earth's magnetic field after the 1962 thermonuclear test at Johnston Island. Analyzed are results of background measurements at altitudes of 220 to 330 km immediately before the explosion, and after the explosion at an altitude of 230 km. Results of Cosmos III and Cosmos V measurements are compared and an attempt is made to explain those factors which may have contributed to counting rate excess. S.C.W.

N67-20453 Washington Univ., Seattle. Dept. of Atmospheric Sciences.
ANNUAL REPORT, 1 DECEMBER 1965–30 NOVEMBER 1966
1 Dec. 1966 40 p refs
(Contract Nonr-477(24))
(AR-6; AD-644570) CFSTI: $3.00

CONTENTS:

1. BARROW, GENERAL 17 p refs (See N67-20454 10-13)
2. CARBON DIOXIDE IN THE SURFACE WATERS OF PUGET SOUND, WASHINGTON J. J. Kelly, Jr. 15 p refs (See N67-20455 10-13)

N67-20454 Washington Univ., Seattle. Dept. of Atmospheric Sciences.

BARROW, GENERAL

In its Ann. Rept., 1 Dec. 1965–30 Nov. 1966 1 Dec. 1966 17 p refs (See N67-20453 10-13) CFSTI: HC$3.00

Summary reports are given of research activities in atmospheric sciences, including radiation, sea ice physics, atmospheric chemistry, and the heat balance of tundra lakes. Radiation climate studies are reported, in which measurements were made of total, net, and reflected short-wave radiation. Short-wave radiation measured over an arctic lake indicated that lakes experience a wider radiation range than the surrounding tundra by absorbing more energy during the day and releasing more at night. In atmospheric chemistry, measurements were made of CO_2, ozone and other oxidants, water vapor, and particulate matter to determine the effects of winds on the transport and modification of gases and particulates in the atmosphere. Attempts to measure a temperature and internal pressure profile in growing sea ice are summarized, and mention is made of work on a sea ice model, arctic climatology, ocean boundary layer, wind-blown snow, and tundra lakes. An annotated bibliography is also included. L.E.W.

N67-20455 Washington Univ., Seattle. Dept. of Atmospheric Sciences.

CARBON DIOXIDE IN THE SURFACE WATERS OF PUGET SOUND, WASHINGTON

John J. Kelly, Jr. *In its* Ann. Rept., 1 Dec. 1965–30 Nov. 1966 1 Dec. 1966 15 p refs (See N67-20453 10-13) CFSTI: HC $3.00

The development of a system to measure the exchange of CO_2 gas across the sea surface is described, and measurements made on shipboard of the equilibrium concentration of CO_2 in Puget Sound, Washington, by the CO_2 equilibrator are reported and discussed. Details are given on the experimental procedure, including sea water sampling system, equilibrating system, reference gases, air system, and relationship of concentration to partial pressure. It was found that the equilibrium CO_2 concentrations for the water in Puget Sound shows supersaturation in CO_2 with respect to the atmosphere at sea level. Data for CO_2 in the air and surface waters of Puget Sound are presented in tabular form. It was concluded that the instrument system used performed satisfactorily, and recommendations are made for future measurements. L.E.W.

N67-20460# Air Force Cambridge Research Labs., Bedford, Mass.

SHEAR STRENGTH, POLYMORPHISM, AND MECHANICAL BEHAVIOR OF OLIVINE, ENSTATITE, DIOPSIDE, LABRADORITE, AND PYROPE GARNET: TESTS TO 920°C AND 60 KB

R. E. Riecker and T. P. Rooney Aug. 1966 69 p refs *Its* Environ. Res. Paper No. 216

(AFCRL-66-543; AD-642925) CFSTI: HC$3.00/MF$0.65

Four hundred and seventeen shear and compression tests were completed on five minerals: olivine, enstatite, diopside, labradorite, and pyrope garnet. These minerals are assumed to represent the principal constituents of an upper mantle rock model. Petrographic examination and X-ray analyses indicate that the minerals deform cataclastically at pellets, pressures and temperatures, with intra-granular flow beginning at 30 kb normal pressure. Temperature enhances ductility, indicated at high pressures by X-ray line broadening on diffraction patterns and the appearance of kink bands in thin sections. Two phenomena of geophysical importance have been discovered during shear testing: (1) dehydration of less than 5 percent by volume of serpentine weakens dunite by more than 30 percent as the temperature is raised from 300C to 520C; (2) orthorhombic enstatite readily inverts to monoclinic polymorph under the influence of shear stress at all pressures and the temperatures to 920C and 50 kb. The inversion is accompanied by a small, rapid change in volume, sufficient to yield seismic energy for the production of a moderate earthquake. Author (TAB)

N67-20484# Aeronautical Chart and Information Center, St. Louis, Mo. Linguistic Section.

DETERMINATION OF THE PARAMETERS OF THE OUTCROPPED DISTURBING LAYER BODIES ACCORDING TO δg ANOMALIES [OPREDELENIYE PO ANOMALIYAM δg PARAMETROV VOZMUSHCHAYUSHCHIKH PLASTOVYKH TEL, VOCHODYASHCHIKH NA DNEVNUYU PROVERKHNOST']

O. D. Ivanov and V. A. Borodin [1966] 11 p refs Transl. into ENGLISH from Razvedka i Okhrana Nedr (Moscow), no. 7, 1966 p 38–41

(ACIC-TC-1141; AD-643484) CFSTI: HC$3.00/MF$0.65

The article describes the methods for determining the depths of occurrences of the lower boundary H, thickness 2d, angle of inclination and excess density of vertical and sloping three dimensional bodies which come to the day surface or are located close to it. TAB

N67-20488# White Sands Missile Range, N. Mex. Atmospheric Sciences Lab.

TECHNIQUES FOR COMPUTING LAUNCHER SETTINGS FOR UNGUIDED ROCKETS

Louis D. Duncan and Bernard F. Engebos Sep. 1966 22 p refs

(ECOM-5077; AD-642856) CFSTI: HC$3.00/MF$0.65

Three techniques for computing the launcher angles required for an unguided rocket to obtain a desired theoretical impact are discussed. These methods take into consideration the fact that the rocket will deviate from its nominal course because of the wind it encounters. One method, a field technique, utilizes the wind weighting principle. The other two utilize an iterative technique on a computer for determining launcher settings. Author (TAB)

N67-20489# Liege Univ. (Belgium). Dept. of Astrophysics.

CELESTIAL SPECTRA AND ATMOSPHERIC EFFECTS MAINLY IN THE INFRARED Final Scientific Report, 1 May 1963–31 May 1966

M. Migeotte 31 May 1966 97 p refs Submitted for publication

(Contract AF 61(052)-685)

(AFCRL-66-728; AD-644594) CFSTI: HC$3.00/MF$0.65

CONTENTS:

1. CELESTIAL SPECTRA AND ATMOSPHERIC EFFECTS MAINLY IN THE INFRARED 25 p refs (See N67-20490 10-13)
2. SEASONAL VARIATIONS OF ATMOSPHERIC OZONE P. Vermande, E. Vigroux (Inst. d'Astrophysique, Paris), and M. Migeotte 37 p refs (See N67-20491 10-13)
3. A TABLE OF THE SOLAR SPECTRUM FROM LAMBDA 7498 TO LAMBDA 12016 W. S. Benedict (JHU/APL), O. C. Mohler (Mich. Univ.), J. W. Swensson, L. Delbouille, and G. Roland 29 p refs (See N67-20492 10-30)

N67-20490# Liege Univ. (Belgium). Dept. of Astrophysics.

CELESTIAL SPECTRA AND ATMOSPHERIC EFFECTS MAINLY IN THE INFRARED

In its Celestial Spectra and Atmospheric Effects Mainly in the Infrared 31 May 1966 25 p refs (See N67-20489 10-13) CFSTI: HC $3.00/MF $0.65

Astronomical observations are reported for interferometric investigation of celestial spectra, earth atmosphere, and the vertical distribution of telluric ozone. Vertical ozone distributions, as well as integrated ozone contents in the pressure ranges 10 to 40 mb and 40 mb to the pressure of the tropopause, were recorded. Consideration is given to wavelengths and possible identifications of the 10,450 lines appearing between 7498 Å and 12016 Å. A summary of observations of the solar spectrum between 3032 Å and 8400 Å is also included. R.Li.

N67-20491# Liege Univ. (Belgium). Dept. of Astrophysics.
SEASONAL VARIATIONS OF ATMOSPHERIC OZONE
M. Migeotte, E. Vigroux, and P. Vermande (Institut d'Astrophysique, Paris) *In its* Celestial Spectra and Atmospheric Effects Mainly in the Infrared 31 May 1966 37 p refs Submitted for publication (See N67-20489 10-13) CFSTI: HC $3.00/MF $0.65

The reduction of astronomical data permitted the total amount of ozone to be determined, and gave information on the vertical distribution of the atmosphere. Two groups of data are presented: the polar vortex from the lower stratosphere upwards (anticyclonic), and the polar cyclic vortex. The latter are considered to be the richest in irregularities and fluctuations of the ozone. The possibility is stated that the supply of ozone in northern regions comes from the equatorial regions through the stratospheric anticyclones and that the possible redistributions from the polar regions southwards, consequently toward mean latitudes, is due to perturbations associated with the ridges and troughs of the troposphere. The anticyclone effect reported can be separated into two parts: the dragging of air polewards within the higher layers which can be, according to the level, the richest in ozone, and subsidence. R.Li.

N67-20540# White Sands Missile Range, N. Mex. Atmospheric Sciences Lab.
STRATOSPHERIC CIRCULATION RESPONSE TO A SOLAR ECLIPSE
Willis L. Webb Oct. 1966 34 p refs
(ECOM-5082; AD-642858) CFSTI: HC $3.00/MF $0.65

The new knowledge gained from Meteorological Rocket Network systems that the stratospheric circulation responds to diurnally impressed solar heating with a temperature variation of approximately 15C and a wind variation of approximately 30 meters per second peak to peak at the stratopause has led to greater interest in other sources of perturbation in this upper atmospheric region. A solar eclipse exhibits physical input characteristics which are sufficiently different from diurnal variations in space and time scales to make its analysis of value in establishing the overall response characteristics of the stratospheric circulation. Employing certain assumptions and using the available data on diurnal variations, a model of the stratospheric temperature and circulation structure associated with an eclipse shadow has evolved. In particular, this model was designed to represent the situation which will occur in the morning hours over Tartagal, Argentina, on 12 November 1966. The results of this study indicate that the diurnal temperature variation will be locally reduced by approximately 4 degrees Celsius along the totality path and that a local circulation system of several thousand kilometers diameter will be set up around the path of the lunar shadow with peak winds of the order of several meters per second. Such a perturbation in the stratospheric circulation can probably be observed with only relatively minor adjustments to available meteorological rocket systems. Author (TAB)

N67-20544# White Sands Missile Range, N. Mex. Atmospheric Sciences Lab.
SPECTRAL TRANSMISSIVITY OF THE EARTH'S ATMOSPHERE IN THE 250 TO 500 WAVE NUMBER INTERVAL. PART IV: A THEORETICAL COMPUTATION FOR PURE ROTATIONAL ABSORPTION Final Report
James T. Hall, C. W. Querfeld, and G. B. Holdale Jul. 1966 99 p refs
(ECOM-5068; AD-641698) CFSTI: HC $3.00/MF $0.65

A theoretical computation for absorption by water vapor, using the rigid asymmetrical top rotor for all angular momentum quantum numbers J < or = 12 and half-widths calculated by Andersons theory, is compared to experimental data over the range of 20 microns to 50 microns. The comparison is made with consideration to determining the best of five line shapes for this spectral interval. The theoretical values of transmissivity are given for all five line shapes using the specific parameters of the experimental spectra. Author (TAB)

N67-20548# New York Univ., N. Y. Research Div.
OPTICAL SOUNDING II, PART II Final Report, 16 Jul. 1965–30 Apr. 1966
E. E. Uthe Ft. Monmouth, N. J., Army Electron. Command, Oct. 1966 99 p refs
(Contract DA-36-039-AMC-03411(E))
(TR-66-11; ECOM-03411-F; AD-643562) CFSTI: HC $3.00/MF $0.65

Atmospheric transmissions are computed for the 15 micron CO2 absorption band. Carbon dioxide absorption is computed using the quasi-random band model (QRBM) with the line positions and strengths as given by Young (1964, corrected 1965). The Lorentz line shape is assumed and the mean half width is determined from the absorption measurements of Burch et al. (1962). The water vapor absorption in this frequency region is computed from an empirical model of Davis and Viezee (1964). The Curtis-Godson approximation is assumed for non-homogeneous vertical atmospheric paths. Frequency interval transmissions are computed for 10/cm increments using a modified triangular response function compatible with QRBM increments of 1/cm. Atmospheric radiation intensities as received at ground level are computed from the integral form of the transfer equation. A criterion is established for determining integration error. The computed spectral intensities are compared with measured intensities. Author (TAB)

N67-20589# Puerto Rico Univ., Mayaguez. Coll. of Agriculture and Mechanic Arts.
IONOSPHERIC DRIFTS DEDUCED FROM SPACE INTERFEROMETER RECORDS Final Report, 29 Feb. 1962–29 Feb. 1964
Braulio Dueno 30 Jun. 1966 58 p refs
(Contract AF 19(628)-3991)
(AFCRL-66-687; AD-642728) CFSTI: HC $3.00/MF $0.65

Correlation analysis of drift data obtained from three spaced interferometers was performed. A surprisingly low value for the drift velocity has been obtained in a large number of cases analyzed. The drift direction and its variation over a twelve month period has been found to be in agreement with scintillation data obtained earlier and analyzed by the Putter straight line technique using the same experimental setup. The characteristic velocity was, in nearly all the cases, much larger than the drift velocity. Only on ten percent of the occasions (seven out of sixty five) the magnitude of the drift velocity V exceeded the characteristic velocity V sub c. There is an uncertainty as to whether V sub c is a measure of the random changes in the irregularities or of the quality of the records. However, the ratio V sub c/V was found to increase twofold for data obtained during the sunrise and pre-sunrise hours when contrasted with data obtained during daylight and early

evening hours. Since noise and interference are smaller during the pre-sunrise hours than during the daylight hours then V sub c is significant in this experiment. Correlation ellipses were found to be oriented in the northwest-southeast quadrants with deviations of from 20 to 40 degrees with respect to the drift velocity. Axial ratios, for the seven cases computed, varied from two to five. A discussion of Yergs six point analysis is included and it is shown that, with certain limitations, the method yields reliable results. Author (TAB)

N67-20574# University Coll., London (England). Physics Dept.
MEASUREMENTS OF ATMOSPHERIC STRUCTURE ABOVE 30 KM USING THE GRENADE METHOD AND IMPROVED ACOUSTIC TECHNIQUES
R. W. Procunier Jul. 1966 132 p refs
(Contract AF 61(052)-781)
(AFCRL-66-777; SR-4; AD-642843) CFSTI: HC $3.00/MF $0.65

The problem of detecting acoustic energy from grenades detonated in the upper atmosphere is considered and the natural pressure fluctuations which tend to limit detectability are discussed. Consideration is given to the most suitable system for obtaining the maximum altitude of detection and it is concluded that this should utilize a hot-wire microphone in conjunction with the newly-developed transmission and recording system. This instrumentation uses a Multiplex System for eliminating electrical transmission noise over a widely spaced microphone array and for providing a magnetic tape record which may be subsequently replayed to recover weak signals. A review of the method of temperature and wind determination from the observed travel time of sound waves is given, and results from four rocket flights at Woomera in October 1963 and one at Eglin in February 1965 are presented. Author (TAB)

N67-20590# Army Cold Regions Research and Engineering Lab., Hanover, N. H.
REEVALUATION OF THE RAMMSONDE HARDNESS EQUATION
Robert Waterhouse Aug. 1966 14 p refs
(CRREL-SR-100; AD-641482) CFSTI: HC $3.00/MF $0.65

The purpose of this report is to provide a rational derivation for a hardness term which relates the Rammsonde number to a simple but more accurate and universal energy equation. Major losses are accounted for and the use of different weights for the test can be accommodated without complicating the evaluation. TAB

N67-20594# National Center for Atmospheric Research, Boulder, Colo.
BALLOONING SUPPORT FOR COSMIC-RAY EXPERIMENTS
Robert S. Kubara and Bertram Stiller (NRL) Sep. 1966 76 p refs Joint U.S.–India Intern. Quiet Sun Yr. Equatorial Expedition, Hyderabad, India, 6 Mar.–9 Apr. 1965
(NCAR-TN-20; AD-641174) CFSTI: HC $3.00/MF $0.65

The National Center for Atmospheric Research organized and provided program management for a balloon expedition to study cosmic rays in the vicinity of the equator during the International Quiet Sun Year (IQSY). A joint United States - India activity, the program was conducted in Hyderabad, India during the late winter and early spring of 1965. A total of 17 flights were scheduled during the period 6 March to 9 April, 1965. Of these, 13 were successful, three were ground failures, and one balloon burst during ascent. The heaviest payload flown weighed 2858 lb. All scientific packages scheduled were successfully flown and recovered. Author (TAB)

N67-20599# Air Force Cambridge Research Labs., Bedford, Mass. Optical Physics Lab.
MEASUREMENT OF THE INFRARED HORIZON OF THE EARTH
Russell G. Walker, Charles V. Cunniff, and Anthony P. D'Agati Sep. 1966 20 p refs *Its* Environ. Res. Papers No. 223
(AFCRL-66-631; AD-642928) CFSTI: HC $3.00/MF $0.65

Radiance Measurements of the Earth's horizon in three infrared spectral regions were made during two Aerobee rocket flights at White Sands Missile Range, New Mexico. Preliminary results indicate equivalent blackbody radiation temperatures in the CO2 band (14.0 - 15.6 microns) varied from 231K to 239K; in the atmospheric window region (10.2 - 11.8 microns) from 205K to 287K; and in the rotational water vapor band (19.5 - 31.8 microns) from 206K to 239K. Numerous dropouts due to clouds are apparent in the atmospheric window and water vapor bands, while no such effect is evident in the CO2 band. The infrared radiometer, stellar aspect sensor and vehicle attitude control system are described, and actual traces of the horizon profiles and outputs from the stellar aspect system are included. Author (TAB)

N67-20610 Boeing Scientific Research Labs., Seattle, Wash.
ISLAND ARCS AND CONVECTION
E. Orowan (MIT) Apr. 1966 23 p refs Presented at the Symp. on Non-Elastic Processes in the Mantle of the Upper Mantle Comm., Intern. Union of Geodesy and Geophys., Newcastle upon Tyne, 19–25 Feb. 1966 Submitted for publication
(D1-82-0532; AD-637140) CFSTI: $3.00/

If island arcs are the outcrops of compressive faults, they cannot be products of a uniform field of compressive stress because their symmetry is lower. The polarity of the curvature, however, is provided if the compression is of convective origin. Incipient faulting is then followed by a convergence of the convective flow towards the fault, causing a convergence of the initially parallel stress trajectories. Since the fault propagates at right angle to the trajectories of maximum compressive stress, its outcrop becomes an arc convex towards the upstream side. In oceanic compressive faults due to convection the two conjugate fault planes are not equivalent because overthrusting of the downstream side by the upstream side would lead to the accumulation of a thick crust which would inhibit the progress of faulting along the plane, and because underthrusting is lubricated by decomposing serpentine, fluxed basalt etc. This seems the reason why apparently in all long-lived oceanic compressive faults the upstream (usually the ocearward) side underthrusts the downstream side. Author (TAB)

N67-20618# Stanford Research Inst., Menlo Park, Calif.
HIGH RESOLUTION ULTRAVIOLET SPECTRAL STUDY OF THE AURORA IN ASSOCIATION WITH SATELLITE EXPERIMENT Final Report
Robert A. Young 24 Oct. 1966 23 p
(Contract DA-49-146-XZ-356)
(DASA-1874; AD-643918) CFSTI: HC $3.00/MF $0.65

Two spectrometers have been adapted for use in aircraft-based observations of auroral events, airglow, or high altitude nuclear tests. The instruments feature image tube detection and wide spectral coverage. The instrumentation and trials in aircraft and on the ground are described and illustrated. TAB

N67-20635# Danish Meteorological Inst., Charlottenlund.
A SPECIAL MAGNETOGRAPH RUN AT GODHAVN GEOPHYSICAL OBSERVATORY Final Report, 1 Jan. 1964–1 May 1966
Knud Lassen 1 Aug. 1966 45 p ref
(Contract AF 61(052)-507)
(AFCRL-66-720; AD-642357) CFSTI: HC $3.00/MF $0.65

The report concerns the determination of formula and baseline values for the period January 1, 1964 to May 10, 1966 for the H-magnetograph run at Godhavn Geophysical Observatory. Author (TAB)

N67-20662# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

ON THE MEASUREMENT OF IONOSPHERIC DRIFTS

L. K. Narovnya, A. A. Kashin, and Ye. G. Andreyev 7 Dec. 1966 8 p Transl. into ENGLISH from Vestn. Mosk. Univ., Ser. III, Fiz.-Astron. (Moscow), no. 1, 1966 p 121–123
(FTD-HT-66-274; TT-67-60198; AD-643628) CFSTI: HC $3.00/MF $0.65

Over the years in the Department of Physics of the Atmosphere (Moscow University) two-frequency ionosphere stations have been developed for the investigation of drifts, absorption of radio waves, and non-linear effects. The station there at present is for the investigation of drifts of small-scale nonuniformities. A schematic diagram is given of the station consisting of a transmitter and two receivers operating in the range of 1–15 megacycles. The authors discuss the operation of the station and the types of components used. It is pointed out that 35mm film or highly sensitive movie film, Pf-3, are used in the photorecorder system. Mention is made of the fact that since November of 1964 drift investigation at four obtained for the dependence of the direction and the value for the drift rate in the F region for January 28, 1965 at 1405 hours. Author (TAB)

N67-20672# Mitre Corp., Bedford, Mass.

SPHERICAL ZONE BOUNDARIES IN PERSPECTIVE PROJECTION

Bernard A. Forest Oct. 1966 52 p refs
(Contract AF 19(628)-5165)
(MTR-92; ESD-TR-66-111; AD-642329) CFSTI: HC $3.00/MF $0.65

The report considers the projection of spherical zone boundaries onto an image plane using the perspective projection. Special cases of this type of mapping includes: the stereographic, the gnomonic, and the orthographic projections. In addition to proving that the image of any spherical zone boundary is a conic section, the formulation of the parameters of that conic section is given. An important aspect of the projection technique lies in the capability of having any point of the sphere as the center of projection and any great circle through that point as the centerline of the mapping. Author (TAB)

N67-20777# Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.

GAMMA-EMISSIONS OF SOME METEORITES AND TERRESTRIAL ROCKS; EVALUATION OF LUNAR SOIL RADIOACTIVITY [EMISSIONS GAMMA DE QUELQUES METEORITES ET ROCHES TERRESTRES EVALUATION DE LA RADIOACTIVITE DU SOL LUNAIRE]

Daniel Nordemann (Ph.D. Thesis—Paris Univ.) 1966 105 p refs In FRENCH
(CEA-R-3017)

The gamma-emissions of some terrestrial rocks and of the meteorites Bogou, Eagle-Station, Granes, and Dosso were studied by quantitative low background gamma spectrometry. These measurements and their interpretation lead to the evaluation of the possible gamma-emissions of several models of lunar soils. Author (NSA)

N67-20839# Colorado State Univ., Fort Collins. Dept. of Atmospheric Science.

LARGE SCALE ATMOSPHERIC TRANSPORT PROCESSES OF RADIOACTIVE DEBRIS Final Summary Report, 1 Dec. 1963–31 Jan. 1967

Elmar R. Reiter Oct. 1966 55 p refs
(Contract AT(11-1)-1340)
(COO-1340-8) CFSTI: HC $3.00/MF $0.65

From December 1, 1963 to January 31, 1967, transport processes carrying radioactive debris from the stratosphere to the troposphere were investigated by means of individual case studies, by statistical techniques considering relatively long periods of time, and by a study of the behavior of the stratospheric polar night vortex during a break-down period. A summary of conclusions which have been published in previous reports is given. Author (NSA)

N67-21078 Kernforschungsanlage, Juelich (West Germany). Zentralinstitut fuer Angewandte Mathematik.

TRANSLATION OF FORMAL SPEECH INTO TOPOLOGICAL STRUCTURES [UEBERSETZUNG FORMALER SPRACHEN IN TOPOLOGISCHE STRUKTUREN]

Walter Petry (Mainz Univ) Sep. 1964 71 p refs In GERMAN
(JUL-174-MA) CFSTI: $3.00

Language elements are defined, expressions are formed, and relations are rearranged within given rules. A system is defined and a method for regenerating results from a permissible system is demonstrated. Elementary and regenerative systems are expressed in terms of mathematical and topological symbols, and limitations are set for topological symbols. A topological solution is derived for systems in a commutative, operative language with inverse operators. Marked objects of a system are mathematically formulated and stated as linear programming problems. Minimization and optimization conditions of inverters for systems of differential equations are given. The results are used in two programs and a decoding matrix for a fully permissible system applicable in the topological solution. Transl. by K.W.

N67-21281# Israel Program for Scientific Translations, Ltd., Jerusalem.

THE USES OF RADIOACTIVE ISOTOPES AND NUCLEAR RADIATION IN THE U.S.S.R. VOLUME FOUR: SEARCH, PROSPECTING, AND EXPLOITATION OF MINERAL RESOURCES

L. I. Petrenko, P. S. Savitskii, and M. A. Speranskii, ed. 1966 358 p Transl. into ENGLISH of the Book "Radioaktivnye Izotopy i Yadernye Izluchaniya v Narodnom Khozyaistve SSSR, 4" Moscow, Gostoptekhizdat., 1961 Proc. of the All-Union Conf., held in Riga, 12–16 Apr. 1960 Published for AEC and NSF
(AEC-TR-6466/4; CONF-600402, Vol. 4) CFSTI: HC $3.00/MF $0.65

Conference papers on current state, advantages, prospects, and trends in radioactivity methods for locating, prospecting, and exploiting mineral resources are presented. For individual titles see N67-21282–N67-21319.

N67-21282# Israel Program for Scientific Translations, Ltd., Jerusalem.

THE PRESENT STATE AND PROSPECTS OF NUCLEAR GEOPHYSICAL METHODS IN EXPLORATION, PROSPECTING, AND EXPLOITATION OF MINERAL RESOURCES

F. A. Alekseev *In its* The Uses of Radioactive Isotopes and Nucl. Radiation in the U.S.S.R., Vol. 4 1966 p 1–4 (See N67-21281 10-13) CFSTI: HC $3.00/MF $0.65

Practical radioactivity methods for prospecting and exploiting petroleum, gas, coal, and ore deposits are surveyed. Several radiometric techniques are discussed, and their relative advantages are assessed. These include gamma ray logging, neutron–gamma ray logging, neutron–neutron logging, gamma–gamma ray logging, the method of induced activity, the isotope method, and photoneutron ray logging. The principal parameters of the apparatus used in

radioactivity logging are listed, and a uniformity is noted. It is shown that the maximum permissible rate is 100 to 200 m/hr for gamma ray logging, and 300 to 400 m/hr for neutron–gamma ray logging. The maximum ambient temperature does not exceed 60° for most types. Limitations in design and equipment are delineated. Also discussed are the research undertaken to develop methods of activation and X-ray radiometric analyses for studying the chemical composition of ores and minerals, and the work in the field of neutrons for investigating boreholes. Tabulated data are presented to show that neutron activation analysis is a rapid method for obtaining such geochemical parameters as the ratios Al:Si, Na:K, and Ca:Mg. M.G.J.

N67-21283# Israel Program for Scientific Translations, Ltd., Jerusalem.

LOGGING WITH GAMMA AND NEUTRON SOURCES ON ORE AND COAL DEPOSITS

Yu. P. Bulashevich, G. M. Voskoboinikov, and L. V. Muzyukin *In its* The Uses of Radioactive Isotopes and Nucl. Radiation in the U.S.S.R., Vol. 4 1966 p 15–28 (See N67-21281 10-13) CFSTI: HC $3.00/MF $0.65

The general prerequisites are discussed for applying neutron methods to deposits of metalliferous and nonmetalliferous mineral resources, and for using density and selective logging methods. Data obtained on radioactivity logging expeditions on ore and coal deposits are assessed, with the mineral resources related to the method of radioactivity logging, the geological tasks performed, and their use and qualitative economic evaluation. The classifications listed include coal, boron, lead and other heavy elements, iron, bauxites, and beryllium. Recommendations for future development are proposed, with the development of gamma–spectrometric devices and powerful (more than 10^8 neutrons/sec) controllable neutron sources identified as the most urgently needed types of apparatus. M.G.J.

N67-21284# Israel Program for Scientific Translations, Ltd., Jerusalem.

CURRENT STATE OF RADIOMETRIC METHODS AND THEIR EFFICIENCY IN STUDIES OF THE GEOLOGICAL SECTIONS IN PETROLEUM, GAS, ORE, AND COAL BOREHOLES

Yu. I. Gordeev, A. A. Mukher, and D. M. Srebrodol'skii *In its* The Uses of Radioactive Isotopes and Nucl. Radiation in the U.S.S.R., Vol. 4 1966 p 29–32 (See N67-21281 10-13) CFSTI: HC $3.00/MF $0.65

Radiometric methods are discussed in relation to their effectiveness in determining the nature of the useful mineral resources. Gamma ray logging furnishes qualitative and, to a certain extent, quantitative information on the natural radioactivity of rocks traversed by the boreholes. The log permits a more accurate lithological description of rocks revealed by the borehole, and a reliable identification of pelitomorphic formations. Its most efficient application is in studies of the geological section in holes drilled for oil and gas. Gamma–gamma ray logging shows variations in the density of rocks cut by the borehole; however, its interpretation is fairly difficult. The method is used almost exclusively in coal prospecting boreholes. Neutron–gamma ray logging, when used under favorable conditions, improves the reliability of interpreting diagrams for identifying promising strata. It is used in about 50% of the boreholes drilled for oil and gas. Selective gamma–gamma ray logging is used to study the spectrum of scattered gamma radiation from a source of comparatively soft radiation. Methods using induced activity and radioactive isotopes are mentioned briefly. M.G.J.

N67-21285# Israel Program for Scientific Translations, Ltd., Jerusalem.

RADIOACTIVITY METHODS IN PROSPECTING FOR COAL DEPOSITS

M. A. Speranskii *In its* The Uses of Radioactive Isotopes and Nucl. Radiation in the U.S.S.R., Vol. 4 1966 p 33–39 (See N67-21281 10-13) CFSTI: HC $3.00/MF $0.65

Techniques for recording gamma ray, gamma–gamma ray, and neutron–gamma logs are discussed, and the relative advantages of each method are assessed. Based on a large scale testing program carried out in the principal coal basins and districts of the U.S.S.R., it was determined that gamma–gamma ray logging was the more advantageous technique. The deficiencies of electric logging are examined in relation to the advantages for radioactive logging methods. These are cited as their suitability for the identification of coal seams and dry horizons, determinations of their thickness and structure, lithology in cased boreholes, and distinguishing and recording coals of all degrees of metamorphism under different geological conditions. It is estimated that a proper logging program could result in an annual 10% increase in the prospected coal reserves. Efforts to increase the geological–economic efficiency of prospecting based on the possibilities of logging methods are reviewed. M.G.J.

N67-21286# Israel Program for Scientific Translations, Ltd., Jerusalem.

RADIOMETRIC EQUIPMENT FOR INVESTIGATION OF BOREHOLES

V. M. Zaporozhets and B. I. Rogov *In its* The Uses of Radioactive Isotopes and Nucl. Radiation in the U.S.S.R., Vol. 4 1966 p 40–47 (See N67-21281 10-13) CFSTI: HC $3.00/MF $0.65

The different types of equipment, which the diverse methods of radioactivity logging require, are discussed in relation to the particular problems involved in the boreholes being investigated. Among the requirements which must be met in practical work are heat resistant equipment, small diameter instruments sufficiently sensitive for neutron logging, miniature radioactive logging devices, and multichannel designs for carrying out various studies simultaneously. Brief descriptions are presented on the equipment developed by various factories and research institutes. These include (1) apparatus suitable for simultaneous or separate gamma ray and neutron–gamma ray logging, in which the discharge counters are used as detectors of gamma ray radiation; (2) single channel apparatus for separate gamma ray, gamma–gamma ray, or neutron–gamma ray logging; (3) miniature single-channel equipment with semiconductors of the gamma-59 type, for investigating oil, coal, and ore boreholes by gamma ray, neutron–gamma ray, and gamma–gamma ray logging; and (4) a four-channel gamma ray logging apparatus with scintillation counters. M.G.J.

N67-21287# Israel Program for Scientific Translations, Ltd., Jerusalem.

THE ECONOMIC EFFECTS OF RADIOMETRIC METHODS IN THE PROSPECTING AND EXPLOITATION OF OIL AND GAS DEPOSITS

G. F. Mikheev and N. G. Feitel'man *In its* The Uses of Radioactive Isotopes and Nucl. Radiation in the U.S.S.R., Vol. 4 1966 p 48–55 (See N67-21281 10-13) CFSTI: HC $3.00/MF $0.65

Criteria for determining the economic efficiency of radiometric techniques are outlined, and ways of achieving these effects are listed. The potential savings in time and money are discussed for several methods, and examples are given. These include: (1) Gamma ray logging of old wells revealed new producing horizons which yielded an additional 1476 tons of petroleum in 1954 to 1958. (2) By locating the oil–water boundary, neutron–gamma ray logging makes it possible to determine the water content of a well and hence the necessity for recompletion. (3) The use of induced activity in perforated wells is economically more effective because it yields correct results and prevents considerable losses. (4) The method of radioactive isotopes permits the selective tapping of thin sandy reservoirs, resulting in increased output. It is concluded

that the perfection of existing methods and, the introduction of new ones will have a tremendous effect on the economy of the U.S.S.R. This is estimated at 5 to 10 billion rubles in 1965, with an initial investment in radiometric research and manufacturing of 1 to 2 billion rubles. M.G.J.

N67-21288# Israel Program for Scientific Translations, Ltd., Jerusalem.

PULSE NEUTRON METHODS IN STUDIES OF THE GEOLOGICAL SECTIONS OF WELLS

F. A. Alekseev, D. F. Bespalov, B. M. Burov, B. G. Erozolimskii, N. V. Popov et al *In its* The Uses of Radioactive Isotopes and Nucl. Radiation in the U.S.S.R., Vol. 4 1966 p 56–62 (See N67-21281 10-13) CFSTI: HC $3.00/MF $0.65

A pulse neutron–neutron method is described, in which the pulse neutron source is used to measure the density of thermal neutrons in time intervals between pulses. Calculations show that after a period of 1000 μsec the readings of an indicator in oil-bearing sand beds (20% porosity) will be 10 times higher than in the saline aquifers (200 c/l NaCl). These data reveal the high sensitivity of the method to chloride content in the fluid which saturates the bed. Experiments were conducted on models of rock beds to assess the use of the pulse method in locating the water–oil contact, and in differentiating between water- and oil-bearing sand beds. Industrial tests of the technique in oil wells were also undertaken. A method of identifying carbon-containing rocks from the gamma radiation of the inelastic scattering of fast neutrons is discussed briefly. It is concluded that the pulse neutron source opens up possibilities for developing the neutron–gamma ray method, including neutron–gamma spectroscopy. M.G.J.

N67-21289# Israel Program for Scientific Translations, Ltd., Jerusalem.

NEW MINIATURE NEUTRON SOURCES

G. N. Flerov, D. E. Erozolimskii, D. F. Bespalov, L. R. Voitsik, D. I. Leipunskaya et al *In its* The Uses of Radioactive Isotopes and Nucl. Radiation in the U.S.S.R., Vol. 4 1966 p 63–69 (See N67-21281 10-13) CFSTI: HC $3.00/MF $0.65

Neutron sources, developed for petroleum geology and geophysics, are described. The miniature borehole pulse neutron generator design is based on the pulse neutron tube. Its principal feature is cited as a combination of the functions of a deuterium ion accelerator and a high-voltage kenotron, doubling the accelerating voltage. The electronic system consists of a high voltage unit, controlling pulse generator with synchronized circuits, a scheme for observing the pulse of the ionic and electronic currents, recording circuit for neutrons, remote control circuit and general power supply of the generator, and surface panel to record pulses from the neutron counters. Details are also given on the portable neutron breeder, a small uranium–aqueous heterogeneous system, which is subcritical with a maximum multiplication factor of K_{ef}=0.997. A polonium–beryllium source provides the initial neutron flux for multiplication; distilled water is used as the moderator for fission neutrons, coolant, and reflector material; and the fuel elements contain uranium enriched with up to 10% U^{235} isotope. Polonium–beryllium, polonium–boron, and polonium–lithium neutron sources are also considered. M.G.J.

N67-21290# Israel Program for Scientific Translations, Ltd., Jerusalem.

BASIC PROBLEMS IN THE THEORY AND METHODOLOGY OF RADIOACTIVITY METHODS FOR INVESTIGATING BOREHOLES WITH ACCELERATORS OF CHARGED PARTICLES

V. M. Zaporozhets, S. A. Kantor, A. I. Kedrov, and V. V. Sulin *In its* The Uses of Radioactive Isotopes and Nucl. Radiation in the U.S.S.R., Vol. 4 1966 p 70–84 (See N67-21281 10-13) CFSTI: HC $3.00/MF $0.65

The use of borehole accelerators of charged particles, capable of generating intense fluxes of neutrons or gamma quanta, is considered from the viewpoint of improving radioactivity logging efficiency. Possible applications are reviewed, and methodological problems of logging with a borehole neutron generator are examined. Pulse neutron–neutron logging, which records neutrons arriving at the detector a certain period after irradiation has ceased, is suggested as a way of increasing the depth penetration in rocks. The simple case of a pulse source of thermal neutrons is given as an example, and it is shown that the penetration depth depends mainly upon the hydrogen content of the bed and is practically independent of the presence of admixtures strongly absorbing thermal neutrons. The optimum rate of logging tool movement along the borehole in oxygen logging is evaluated; the pulse regime is considered more advantageous than the stationary regime. A detailed description is presented on a neutron generator used as the radiation source in a radioactivity logging tool with two luminescence counters. Test data are included, and design modifications suggested. M.G.J.

N67-21291# Israel Program for Scientific Translations, Ltd., Jerusalem.

INVESTIGATION OF BOREHOLES BY METHODS BASED ON RADIOACTIVE ISOTOPES

A. A. Korzhev *In its* The Uses of Radioactive Isotopes and Nucl. Radiation in the U.S.S.R. Vol. 4 1966 p 85–91 (See N67-21281 10-13) CFSTI: HC $3.00/MF $0.65

Several examples are given to show how radioactive isotopes are used in the petroleum industry for controlling the technical conditions of wells, and developing producing reservoirs. Their application to industrial geology problems is also discussed, with interest centered on the identification of previous beds in producing deposits by means of isotopes in the drilling of wells. The main requirements are that the solutions should not be adsorbed by rock particles, and should not form chemical compounds with the solid and liquid phases of the investigated medium. Experimental data are given to show that, in aqueous solutions of hydrochloric or sulfuric acids (acidities of the order of 3 N), ions of Fe^{59} remain practically unadsorbed by the clay particles, and are found in the liquid phase in the free state. Measurements of quartz sand samples saturated with a solution of I^{131} or Fe^{59} show that the gamma activity is proportional to the physical porosity of the sample. The difficulties encountered due to the use of long-lived isotopes are discussed, and the employment of isotopes with half-lives up to a few hours is suggested. M.G.J.

N67-21292# Israel Program for Scientific Translations, Ltd., Jerusalem

THE POSSIBILITIES OF RADIOMETRY IN BOREHOLES FOR ESTIMATING ROCK POROSITIES

Sh. A. Guberman, V. V. Larionov, and A. I. Kholin *In its* The Uses of Radioactive Isotopes and Nucl. Radiation in the U.S.S.R., Vol. 4 1966 p 92–102 (See N67-21281 10-13) CFSTI: HC $3.00/MF $0.65

Defects in standard radiometric equipment, and undeveloped evaluation techniques are discussed in relation to the problem of obtaining quantitative determination of rock porosities. A method is proposed whereby a series of factors which interfere with porosity evaluations can be considered or eliminated. Emphasis is placed on the following: (1) The unit of measurement by neutron methods should be selected, with the variation in the differentiating capacity of the individual pieces of apparatus taken into account. (2) In plotting standard curves, it is important to know whether the results obtained by neutron methods are affected by differences in the chemical composition of the rock structure. (3) The effect of rock lithology should be considered. (4) The procedure of using the results obtained by neutron methods should include techniques for correcting the distorting effect of their clay content, the salinity of the brines, and the measuring conditions in the well. M.G.J.

N67-21293# Israel Program for Scientific Translations, Ltd., Jerusalem.

DEVELOPMENT OF AN INDUSTRIAL METHOD FOR DETERMINING THE POROSITY OF BEDS BY NEUTRON–GAMMA RAY LOGGING

N. K. Kikharenko, Ya. N. Basin, and N. Y. Polukhina *In its* The Uses of Radioactive Isotopes and Nucl. Radiation in the U.S.S.R., Vol. 4 1966 p 103–112 (See N67-21281 10-13) CFSTI: HC $3.00/MF $0.65

The principal defects of various methods and equipment for porosity determination by neutron–gamma ray logging are listed, and the results of research to evolve an industrial method are described. Techniques for improving the sensitivity of neutron- gamma ray logging instruments toward the porosity parameter are discussed, with emphasis placed on length, the quality of screening between the neutron source and the detector, the use of detectors with relatively high spectrum sensitivity in the region of hard radiation, the choice of material, and thickness of the instrument casing. As neutron–gamma ray logging is affected by numerous factors related to the conditions of measurement in wells and the specific features of beds, experiments on model beds were conducted to determine the effects of the mud cake and the salinity of the mud. Work on standard porosity curves is summarized. M.G.J.

N67-21294# Israel Program for Scientific Translations, Ltd., Jerusalem.

LOCATION OF THE CONTACT ZONE IN OIL-BEARING AND WATER-BEARING CARBONATE BEDS BY THE METHOD OF INDUCED ACTIVITY

B. E. Fel'dman and L. Z. Tslav *In its* The Uses of Radioactive Isotopes and Nucl. Radiation in the U.S.S.R., Vol. 4 1966 p 113–119 (See N67-21281 10-13) CFSTI: HC $3.00/MF $0.65

Field test data are presented to show that the induced activity method is effective in determining the contact zone of oil- and water-bearing carbonate collectors in cased and uncased wells. Findings indicate: (1) Sodium is a convenient indicator element in locating the top of water-bearing beds in cased wells. (2) Chlorine is regarded as the basic indicator element in uncased wells. (3) The filling of the collector with petroleum of high vanadium content makes it possible to locate the base of the petroleum reservoir. Measurements in uncased wells are considered more effective as the absence of the casing and the cement ring permits direct activation analysis of the collector itself, which can be tested for such elements as vanadium, chlorine, and magnesium. M.G.J.

N67-21298# Israel Program for Scientific Translations, Ltd., Jerusalem.

DETERMINATION OF NATURAL TRITIUM FOR PURPOSES OF HYDROGEOLOGY AND HYDRAULIC ENGINEERING

V. N. Soifer *In its* The Uses of Radioactive Isotopes and Nucl. Radiation in the U.S.S.R., Vol. 4 1966 p 148–153 (See N67-21281 10-13) CFSTI: HC $3.00/MF $0.65

Experimental data are presented on the development of a highly sensitive apparatus for recording natural tritium; its primary purpose is the application of tritium dating of waters to the exploitation of petroleum deposits, when the water is injected into the reservoir for more efficient oil production. It is pointed out that selecting the method for tritium recording is limited by its extremely low concentration natural waters (about 10^{-18} tritium atoms per protium atom). Detection is limited to the counting of gaseous hydrogen samples inside a Geiger–Mueller counter or diffusion chamber, with preliminary enrichment of the sample by electrolysis. The laboratory installation consists of a three-stage electrolytic chain, and a low-background counter. Samples are first purified by distillation; electrolyte concentration is 30 g/l. Specific experiments are discussed, and it is concluded that the possible accuracy of dating water within the first 10 years is ±1 year, and that the sensitivity of the apparatus makes it possible to differentiate between waters which are not more than 50 years old. M.G.J.

N67-21300# Israel Program for Scientific Translations, Ltd., Jerusalem.

THE METHOD OF SCATTERED GAMMA RADIATION IN STUDIES OF ORE BOREHOLE SECTIONS

M. M. Sokolov, A. P. Ochkur, A. A. Fedorov, A. Yu. Bol'shakov, and P. P. Khitev *In its* The Uses of Radioactive Isotopes and Nucl. Radiation in the U.S.S.R., Vol. 4 1966 p 162–170 (See N67-21281 10-13) CFSTI: HC $3.00/MF $0.65

Details are given on a two-channel differential scintillation gamma spectrometer developed for gamma–gamma and gamma ray logging, and for recording the energy spectra of scattered and natural gamma radiation at points. The two identical channels make it possible to record simultaneously the intensities of any two regions of the gamma spectrum. The instrument can be used for other types of radioactivity logging, and several examples of its use are presented. Work carried out on several polymetallic deposits, as well as on tungsten, mercury, and iron deposits, demonstrated that gamma–gamma ray logging can reliably identify heavy elements in borehole sections and, in some cases, even elements of medium atomic numbers. When the method was applied to blastholes and perforated boreholes in underground mines, it was found possible to contour the ore bodies, assess the content of useful metal, qualitatively describe the ores, and establish zones of tectonic disturbances traversed by the borehole. M.G.J.

N67-21302# Israel Program for Scientific Translations, Ltd., Jerusalem.

THE POSSIBILITY OF ACTIVATION WITH FAST NEUTRONS IN THE BOREHOLE

K. I. Yakubson *In its* The Uses of Radioactive Isotopes and Nucl. Radiation in the U.S.S.R., Vol. 4 1966 p 175–180 (See N67-21281 10-13) CFSTI: HC $3.00/MF $0.65

To study the processes involved in fast neutron activation of rocks, experiments were conducted on models of sand and bauxite beds of different chemical compositions. Activation was performed with a polonium–beryllium source of fast neutrons. Measurements were made of the gamma radiation intensity of radioactive Al^{28} produced in rocks by two neutron-induced nuclear reactions, $Al^{27}(n,\gamma)Al^{28}$ in the capture of thermal neutrons, and $Si^{28}(n,p)Al^{28}$ in the capture of fast neutrons with energies of 4 MeV and higher. The data obtained on silicon activation are assessed, and several methods are suggested to eliminate its effect in determining the aluminum content of bauxite. A technique for differentiating the induced activity of bauxites into magnesium and aluminum components is presented. Based on these data, a method is proposed for determining the aluminum content and silicon modulus of bauxites in boreholes. M.G.J.

N67-21303# Israel Program for Scientific Translations, Ltd., Jerusalem.

PHOTONEUTRON METHOD FOR THE SEARCH, PROSPECTING, AND ASSAYING OF BERYLLIUM ORES

A. K. Sen'ko *In its* The Uses of Radioactive Isotopes and Nucl. Radiation in the U.S.S.R., Vol. 4 1966 p 181–190 (See N67-21281 10-13) CFSTI: HC $3.00/MF $0.65

Descriptive data are presented on an apparatus designed for the quantitative analysis of beryllium ore powder samples, concentrates, and products of their metallurgical processing. The apparatus consists of a laboratory neutron radiometer, and a detector comprising a measuring chamber with a preamplifer attached to its casing. In the measuring chamber, beryllium samples are

irradiated with gamma rays and the neutrons emitted are detected by four proportional gas-filled boron counters of slow neutrons enriched in B^{10}. Improved apparatus was developed, and laboratory and industrial studies were conducted to apply the photoneutron method to prospecting for beryllium deposits, to assaying beryllium ores in situ, and to photoneutron logging of boreholes for beryllium. From the data obtained, it was concluded that the photoneutron method is superior to spectroscopic determinations and is not inferior to the chemical method. M.G.J.

N67-21304# Israel Program for Scientific Translations, Ltd., Jerusalem.

INTERPRETATION OF COMPLEX GAMMA SPECTRA IN THE ANALYSIS OF ACTIVATED ROCK SAMPLES

A. A. Abdullaev, E. M. Lobanov, A. P. Novikov, and A. A. Khaidarov *In its* The Uses of Radioactive Isotopes and Nucl. Radiation in the U.S.S.R., Vol. 4 1966 p 191–198 (See N67-21281 10-13) CFSTI: HC $3.00/MF $0.65

A scintillation gamma spectrometer technique is described for simultaneously determining the concentrations of several elements in a single sample. In rock analyses, simultaneous identification of isotopes is made from their half-lives and from the energies of their gamma radiations. Time variations in the intensities of photopeaks are recorded, and half-life curves are plotted within energy regions of the spectrum which are characteristic of each element, and in which this element furnishes a major fraction of the radiation. It is pointed out that this makes it possible to qualitatively and quantitatively analyze multicomponent mixtures without destroying the sample. The method was applied to the analysis of scheelite-bearing amphibole–pyroxene skarns, and the percentage contents of tungsten and other elements in the ores were determined. Based on the data presented, it was concluded that activation logging on tungsten deposits may be possible, and that the technique is basically suitable for radioactive logging of boreholes. M.G.J.

N67-21308# Israel Program for Scientific Translations, Ltd., Jerusalem.

THE APPLICATION OF RADIOACTIVE ISOTOPES AND NUCLEAR RADIATIONS TO INVESTIGATIONS OF WELLS IN AZERBAIDZHAN

S. L. Abramyan, S. M. Aksel'rod, and L. A. Putkaradze *In its* The Uses of Radioactive Isotopes and Nucl. Radiation in the U.S.S.R. Vol. 4 1966 p 222–231 (See N67-21281 10-13) CFSTI: HC $3.00/MF $0.65

Methods for determining the input profile of wells are described. Emphasis is placed on activated suspension, with the radioactive substance in the solid phase introduced into the flow of the fluid injected into the well; and on the radioactive flow meter technique, based on measuring the flow rate of water in the string. The relative advantages and disadvantages of each are assessed. A method is also proposed for tracing the water–oil contact from induced activity of Mn in reservoirs. This involves lowering a neutron source in a special container filled with manganese metal or compound into the well to a predetermined depth. The container is adjusted at this depth, and the induced activity of the manganese is measured after the irradiation is completed and the neutron source removed from the container. Results of laboratory tests are presented. Data are also included to show that the tracing of the water–oil contact with boron is basically possible. M.G.J.

N67-21309# Israel Program for Scientific Translations, Ltd., Jerusalem.

RADIOMETRIC STUDIES AND ISOTOPES IN INVESTIGATIONS OF THE OIL FIELDS OF THE CHECHEN-INGUSH ASSR AND THE STAVROPOL TERRITORY

G. A. Shnurman *In its* The Uses of Radioactive Isotopes and Nucl. Radiation in the U.S.S.R. Vol. 4 1966 232–241 (See N67-21281 10-13) CFSTI: HC $3.00/MF $0.65

Gamma ray and neutron–gamma ray logging techniques, and radioactive isotope methods are discussed, based on actual field use in solving petroleum geology problems. Details are given on a single channel tool for radioactivity logging, designed for reliable operation in wells with temperatures up to 200° and pressures up to 800 atm. The high voltage generator was simplified, and nontemperature-resistant components and aggregates were replaced. To obtain a detailed interpretation of industrial–geophysical data, a technique was developed to identify oil reservoirs in the carbonate section and to quantitatively estimate their fracturing. This is based on a comparison of neutron–gamma ray logs with resistivities determined by lateral logging. Experiences are cited to show the advantages of using the isotope method to determine the water–oil contact. The use of standardized logging tools, and the calibration of radioactive logging equipment are also reported. M.G.J.

N67-21310# Israel Program for Scientific Translations, Ltd., Jerusalem.

RADIOACTIVE RADIATIONS AND ISOTOPES IN INVESTIGATIONS OF OIL WELLS IN THE TATAR ASSR

D. A. Shapiro *In its* The Uses of Radioactive Isotopes and Nucl. Radiation in the U.S.S.R., Vol. 4 1966 p 242–251 (See N67-21281 10-13) CFSTI: HC $3.00/MF $0.65

Several examples are given to show the value of gamma ray, neutron–gamma ray logging, neutron–neutron logging with thermal neutrons, induced activity, and radioactive isotopes in solving industrial–geophysical problems. Particular emphasis is placed on their use in mass investigations for checking the movement of water in oil fields. The economic importance of these techniques are assessed in terms of the increased extraction of millions of tons of oil, and in the amount of rubles which are saved. M.G.J.

N67-21311# Israel Program for Scientific Translations, Ltd., Jerusalem.

APPLICATION OF THE METHOD OF INDUCED ACTIVITY TO CHECK THE FLOODING OF OIL DEPOSITS IN THE TATAR ASSR

E. B. Blankov and T. N. Blankova *In its* The Uses of Radioactive Isotopes and Nucl. Radiation in the U.S.S.R., Vol. 4 1966 p 252–262 (See N67-21281 10-13) CFSTI: HC $3.00/MF $0.65

The physical principles of the induced activity method are defined. Its application to the differentiation of oil- and water-bearing collectors in terrigenous deposits was performed in two modifications: induced activity with Cl (indicator element being chlorine), and with Na (with the isolation of the Na radiation). Only sodium was used in carbonate deposits investigations. Details are given on the measurement techniques, and calculation of nomograms for processing the results. Induced activity measurements were also used in wells to detect the movement of brine, and to determine its direction. The economic advantages which accrue from the use of radiometric methods in controlling oil field flooding are considered to be : (1) Knowledge of the water–oil contact position before sealing off the formations eliminates work repetition. (2) Complete knowledge of the progress of flooding, under artificially maintained reservoir pressure conditions, makes possible a substantiated injection of water and the withdrawal of oil from the reservoir. This permits a uniform contraction of the oil-bearing contour, and prevents loss of petroleum as a result of it being bypassed. M.G.J.

N67-21312# Israel Program for Scientific Translations, Ltd., Jerusalem.

ANOMALOUS NEUTRON PARAMETERS OF CHLORINE NUCLEI IN CONTROLLING THE FLOODING OF OIL FIELDS

I. L. Dvorkin, B. M. Orlinskii, and A. N. Plokhotnikov *In its* The Uses of Radioactive Isotopes and Nucl. Radiation in the U.S.S.R., Vol. 4 1966 p 263–272 (See N67-21281 10-13) CFSTI: HC $3.00/MF $0.65

As the nuclei of chlorine atoms possess a large thermal neutron capture cross section and emit about three gamma quanta during the capture of a neutron, aquifers in regions of high salinity of brines are marked on neutron–gamma ray logs by higher readings than oil reservoirs. Thus this technique has become the most widely used method in determining the position of the water–oil contact in wells. Several examples of practical applications in industrial fields are given to show its use in investigations of nonperforated and perforated beds. Details are also given on the development of apparatus and equipment for investigating flowing oil wells, in which the logging tool is lowered into the tubing by means of a cable moving through a special packing in the flow head. Tabulated data are presented to show the results obtained in 13 wells, 10 of which yielded oil containing not over 5% water on the day of radioactivity logging. A method of combined measurements in a stimulated standing well is also described. M.G.J.

N67-21313# Israel Program for Scientific Translations, Ltd., Jerusalem.

METHOD OF SCATTERED NEUTRONS AND GAMMA RAYS IN STUDIES OF MOISTURE AND DENSITY OF ROCKS

A. E. Babinets and S. T. Zvol'skii *In its* The Uses of Radioactive Isotopes and Nucl. Radiation in the U.S.S.R., Vol. 4 1966 p 273–282 (See N67-21281 10-13) CFSTI: HC $3.00/MF $0.65

Studies on the balance of moisture in the first aquifer, and on the nature of soil compaction in the natural occurrence by detonating were combined with a search for methods of investigating density and moisture distribution in soils. The use of radioactive isotopes was considered, and field methods for moisture measurements in sandy–clayey rocks were based on the interaction of neutrons from a polonium–beryllium source with the rock substance. Investigations of mass densities of rocks in situ were based on the specific features of gamma radiation interaction from a cobalt source with the rock substance. The scattering method is also considered promising for engineering geology; this involves evaluating the scattering of radiation by rocks from cobalt and polonium–beryllium sources. It was shown that the combined use of these sources made it possible to simultaneously determine the volumetric weight and the natural moisture content of these rocks. Tabulated data are presented on the values of the volumetric weight of rocks and their framework, and their natural moisture content, as interpreted from point measurements of scattered radiation. M.G.J.

N67-21319# Israel Program for Scientific Translations, Ltd., Jerusalem.

THE USE OF RADIOACTIVE ISOTOPES IN THE NORTHERN SAKHALIN OIL FIELDS

V. O Palagnin *In its* The Uses of Radioactive Isotopes and Nucl. Radiation in the U.S.S.R., Vol., 4 1966 p 312–314 (See N67-21281 10-13) CFSTI: HC $3.00/MF $0.65

Survey data are presented on the use of radiometric methods in the industrial–geophysical investigations of oil and gas wells. These include gamma ray and neutron–gamma ray logging methods, and radioactive isotopes for studying the technical conditions of wells. A critical assessment of equipment reliability is included, and the need of developing techniques for the interpretation of logs is stressed. M.G.J.

N67-21324# Pacific Missile Range, Point Mugu, Calif.

CONSTANT PARAMETER STEADY-STATE DIFFUSION

C. J. Thorne and E. D. Simmons 30 Sep. 1966 41 p refs (PMR-TM-66-7; AD-644151) CFSTI: HC $3.00/MF $0.65

Analytic solutions are presented for two- and three-dimensional steady-state diffusion problems with constant coefficients. Assumptions of the mathematical model used are: (1) source concentration is known in the source plane, (2) rate of absorption of material into the surface or deposit of material upon the surface is known and is proportional to concentration, (3) concentration at any point is steady state (i.e., independent of time), (4) wind velocity is constant, and (5) the coefficient of diffusion (K) is constant. A general steady-state two-dimensional solution is determined for an arbitrary source concentration function and is given in terms of convolution integrals. The solution is given for sectionally linear discontinuous source concentration functions in terms of dimensionless parameters. A method is developed to extend the two-dimensional results of parts 1 and 2 to three dimensions. Solutions are given for three-dimensional planar source concentration functions symmetric in the plane perpendicular to the wind. Author (TAB)

N67-21335# White Sands Missile Range, N. Mex. Atmospheric Sciences Lab.

MIDLATITUDE CLOUDS IN THE UPPER ATMOSPHERE

Willis L. Webb Nov. 1966 29 p refs (ECOM-5090; AD-644820) CFSTI: HC $3.00/MF $0.65

A strong interest in upper atmospheric clouds as indicators of the stratospheric circulation has resulted from new knowledge obtained through Meteorological Rocket Network synoptic exploration of that region. A year-long observational program conducted by missile range meteorologists and several U. S. Weather Bureau stations indicates that natural occurrence of clouds visible to the unaided eye is not a characteristic feature of the region which can be efficiently observed. Shortcomings of the available data and characteristics of a more effective observational system are discussed. Author (TAB)

N67-21347# Aeronautical Chart and Information Center, St. Louis, Mo. Linguistic Section.

DENSITY CHARACTERISTICS OF SEDIMENTARY ROCKS IN THE CENTRAL PART OF THE DEPRESSION OF THE BLACK SEA REGION [PLOTNOSTNAYA KHARAKTERISTIKA OSADOCHNYKH POROD TSENTRAL'NOY CHASTI PRI-CHERNOMORSKOY VPADINY]

V. Ye. Burakovskiy, B. L. Gurevich, and V. A. Dyadyura Dec. 1966 19 p refs Transl. into ENGLISH from Akad. Nauk Ukr. SSSR, Geofiz. Sb. (USSR), v. 12, Issue No. 1, 1965 p 127–134 (ACIC-TC-1146; TT-67-60396; AD-645019) CFSTI: HC $3.00/MF $0.65

It is advisable to analyze the density characteristics of the rocks in conformity with their tectonic zonation. Thus, the following regions were singled out in the Central Black Sea region: The northern side of the depression of the Black Sea region. Within its boundaries, the sedimentary Mesocenozoic rocks lie on the Pre-Cambrian foundation, sinking in a single, oblique inclination towards the central, downwarped part of depression. Its southern side, in which the sedimentary rocks form the gentle folds, complicated by dislocations; sedimentary deposits of the Mesocenozoic era lie here under the folded foundation of the Jurassic-Triassic age. The Indol-Kuban foredeep; the Mesocenozoic deposits in it reach a considerable thickness (more than 10 km), accumulated during the long period of sedimentation. TAB

N67-21349# Aeronautical Chart and Information Center, St. Louis, Mo. Linguistic Section.

ON THE DEPENDENCY OF THE VALUE OF BOUGUER ANOMALY ON THE THICKNESS OF THE EARTH'S CRUST [O ZAVISIMOSTI VELICHINY ANOMALII BOGE OT MOSHCHNOSTI ZEMNOY KORY]

P. Ya. Galushko Dec. 1966 17 p refs Transl. into ENGLISH from Akad. Nauk Ukr. SSSR, Geofiz. Sb. (USSR), v. 12, Issue No. 1, 1965 p 27–31
(ACIC-TC-1145; TT-67-60395; AD-645018) CFSTI: HC $3.00/MF $0.65

On the grounds of the adduced facts, it is believed that a direct dependency between the Bouguer anomalies and the crusts thickness, obtained by averaging in one or another manner the thickness values and the appropriate values of anomalies, is physically unsubstantiated, and does not comply with the actual situation. Therefore, the interpretation results of gravity field, based on this dependency, and especially the generalizing conclusions from these results, cannot be accepted even in a capacity of a first approximation. All this refers to the continental regions. For the territory of the world oceans, where the single-layer structure of the earths crust is known beforehand, the direct dependency between the values of Bouguer anomalies and the depth of Mohorovicic discontinuity has a real meaning, if the reduction for the deficiency of the masses of sea water is made correctly. TAB

N67-21397*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
GEOLOGIC APPLICATIONS OF ORBITAL PHOTOGRAPHY
Paul D. Lowman, Jr. Feb. 1967 50 p refs
(NASA-TM-X-55724; X-641-67-68) CFSTI: HC $3.00/MF $0.65 CSCL 08B

Potential geologic applications of orbital photography (photography of the surface of the earth or similar bodies from orbiting spacecraft, by returned film or television) are discussed with illustrations from various Gemini flights. Advantages of orbital photography over conventional aerial photography are listed. They include: large area per photograph, rapid coverage, and wide range of scales. Major limitations discussed include: restriction by orbital characteristics, cloud cover, daylight restrictions, and atmospheric scattering. The major specific geologic uses of orbital photography are described as regional geologic mapping, monitoring of variable properties, and geologic education. Theoretical applications of orbital photography are expected to focus on the continental drift, structure of rift valleys, study of transcurrent faulting, the existence of a global tectonic pattern, and other geologic problems. For maximum usefulness of orbital photography, supplemental use of other space-borne sensors is advocated. S.P.

N67-21450* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
PAGEOS PROJECT. COMPILATION OF INFORMATION FOR USE OF EXPERIMENTER
David E. Bowker Washington, NASA, Mar. 1967 100 p refs
(NASA-TM-X-1344) CFSTI: $3.00 CSCL 08E

This compilation of experimenter information for use with the inflatable geodetic satellite contains a general description of the satellite triangulation method and the camera requirements for passive satellite photography. Included are a mathematical analysis of the gravitational field of the earth as seen from satellite altitudes; a map of the earth interrelating various geodetic data with a standard earth-centered coordinate system; and a discussion of the various observing techniques and their effectiveness and accuracy. G.G.

N67-21453* National Aeronautics and Space Administration, Washington, D. C.
INFLUENCE OF THE EARTH'S MAGNETIC FIELD ON THE DIURNAL VARIATION OF f_0F2 (FOURIER ANALYSIS) [EINFLUSS DES ERDMAGNETFELDES AUF DEN TAGESGANG VON f_0F2 (FOURIER-ZERLEGUNG)]
R. Eyfrig Mar. 1967 14 p refs Transl. into ENGLISH of a paper presented at the Intern. Radio Union, 15th Gen. Assembly, Munich, 5–19 Sep. 1966
(NASA-TT-F-463) CSCL 08N

A brief comparison of available studies of the influence of the earth's magnetic field on the diurnal variations of the F2 ionosphere layer is given to demonstrate that optimum data on the physical control effects are obtained by a Fourier analysis of the diurnal variations of f_0F2. The analysis was extended over two months during the sunspot maximum in June and December 1958. The analysis indicates that the permanent maximum of spread-F is located east of the magnetic pole, close to Foxe Basin. A diagram of the numerical values for the phase angle of the first harmonic for f_0F2 indicates that much higher phase angles are observed in the western declination zones than in the eastern zones. An influence of the magnetic declination on the amplitudes of the first harmonic is substantiated. The maximum of the fundamental a_0 at the magnetic pole is attributed to electrons entrained over the lines of force of the earth's field or to corpuscular radiation. Author

N67-21460*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
POLARIZATION AND INTENSITY MEASUREMENTS OF HYDROGEN LYMAN ALPHA IN THE DAY AIRGLOW
Donald F. Heath Mar. 1967 10 p refs
(NASA-TM-X-55731; X-622-67-114) CFSTI: HC $3.00/MF $0.65 CSCL 04A

This paper is concerned with the measurements of polarization and intensity in the day airglow of Ly-α. The polarization and intensity were measured as a function of altitude for the principal far ultraviolet day airglow emission features from 1200A to 2000A. These included the hydrogen Ly-α line at 1216A, the resonance lines of OI at 1304A, and the group at 1355A, and an unidentified source of emission in the region from 1450A to 2000A. Author

N67-21695# Queens Univ., Belfast (Northern Ireland). Dept. of Applied Mathematics.
ATMOSPHERIC NITROUS OXIDE
D. R. Bates and P. B. Hayes Sep. 1966 22 p refs
(Contract AF 61(052)-780)
(AFCRL-66-823; SR-17; AD-644516) CFSTI: HC $3.00/MF $0.65

Information relating to atmospheric nitrous oxide is reviewed. Measurements by several groups show that the fractional volume abundance f (N2O) is about 2.5 x 10 to the -7th power in the troposphere. Photo dissociation is the most important destruction process. Its effectiveness is reduced by the finiteness of the vertical exchange coefficient which prevents nitrous oxide being transported up through the stratosphere fast enough to keep f (N2O) from decreasing with altitude. To balance the mean loss by photo dissociation there must be a source providing 2 to 3 x 10 to the 9th power N2O molecules / sq. cm sec over the surface of the Earth. The most probable source is microbiological as first suggested by Adel. However the slow homogeneous chemical reaction between ozone and nitrogen is not excluded by the laboratory work reported. Author (TAB)

N67-21740# Naval Ordnance Lab., White Oak, Md.
THE "DEEP DIP" AUTOMATIC INSTRUMENTED DIVING ASSEMBLY (AIDA)
Abraham Silverstein and Frank G. Salton 13 Oct. 1966 56 p
(NOLTR-66-165; AD-644522) CFSTI: HC $3.00/MF $0.65

A number of versatile deep sea diving assemblies were developed and produced at the Naval Ordnance Laboratory. These are capable of taking tons of equipment to the bottom of the

deepest sea and returning after a preset time with recorded data. The assembly has no inherent sonic, magnetic, or electromagnetic fields. Author (TAB)

N67-21750# Eidgenossische Technische Hochschule, Zurich (Switzerland).
NON-VERTICAL GEODESY
Mohammed Id Ozone (Ph.D. Thesis) 1966 70 p refs
(Rept.-3825) CFSTI: HC $3.00/MF $0.65

Non-vertical geodesy is defined as a method in which observations are not reduced to any surface of reference, and corrections for deviation of the vertical and for skew normals are consequently not required. To permit this simplification, computations are carried out in three-dimensional space. For this purpose the absolute system is considered as the most universal rectangular system that can be fixed to the Earth. But since observations normally refer to fixed points, it is suggested to start computations in a three-point local system. The observations thus result in local coordinates from which the absolute coordinates can be computed. It follows the determination of the ellipsoid equation in the absolute system. The method is useful for measurements with artificial satellites. Transl. by K.W.

N67-21774# Atomic Energy Commission Research Establishment, Riso (Denmark). Dept. of Physics.
OBSERVATION OF GAUSSIAN AND NON-GAUSSIAN TURBULENT VELOCITY DISTRIBUTIONS
O. Kofoed-Hansen Sep. 1962 23 p refs
(RISO-45) CFSTI: HC $3.00/MF $0.65

Smoke diffusion observations and measurements of wind velocity fluctuations are reported. In cases where the wind velocity fluctuation distributions are Gaussian, good agreement is obtained with the theory developed previously. Non-Gaussian wind velocity fluctuation distributions are reported, and it is shown in agreement with expectations that such situations cannot be described by the above-mentioned theory. Author (ESRO)

N67-21781# Massachusetts Inst. of Tech., Cambridge. Dept. of Meteorology.
PROPAGATORS OF ATMOSPHERIC MOTIONS
Robert E. Dickinson 1 Jul. 1966 254 p refs
(Contract AT(30-1)-2241)
(MIT-2241-26) CFSTI: HC $3.00/MF $0.65

Propagation of linear wave motions in inviscid, stratified, ideal gas atmospheres is described by obtaining the relevant propagators. The transient acoustic oscillations, buoyancy oscillations, and gravity waves for an unbounded non-rotating atmosphere are derived. Introduction of the hydrostatic assumption is found to eliminate the acoustic and buoyancy oscillations and modify the gravity wave. Time independent potential vorticity motions result for an atmosphere in constant rotation, but these lose their energy by radiation when the influence of the earth's variable vorticity is taken into account. A "filtering" method of synthesizing propagation equations for elementary propagators from their contour integral representations is given. The excitation of the Lamb boundary wave from a point heat source is analyzed. Rossby wave motions and gravity wave motions for an unbounded planar atmosphere are obtained. The quantitative details are obtained by steepest descent integrations, but the "group velocity" concept is adequate for a qualitative description of the resulting motions. Theoretical analysis of forced hydrostatic atmospheric wave motions on a rotating sphere is given. A conservation of energy equation is obtained, several related spectral theorems are established, and the integration of the equation for forced tidal motions on a sphere is discussed. An example of the motion of a convectively unstable atmosphere is given to illustrate instabilities that grow asymptotically. Author (NSA)

N67-21838# Ludwig-Maximilians-Universitat, Munich (West Germany). Meteorologisches Institut.
INVESTIGATION OF THE INFRARED EMISSION SPECTRUM OF THE ATMOSPHERE AND EARTH Annual Summary Scientific Report No. 2, 1 Feb. 1965–30 Apr. 1966
Guenter Kuers 28 Jul. 1966 32 p refs
(Contract AF 61(052)-778)
(AFCRL-66-664; AD-642841) CFSTI: HC $3.00/MF $0.65

The vertical distribution of sky radiation in the wavelength region 0.4-2.2 microns is given for two flights made in June 1965. The measurements were made from a helicopter with an interference filter radiometer in the suns almucantar. Extinction coefficients for aerosol scattering are deduced from the radiance data. Author (TAB)

N67-21839# Danish Meteorological Inst., Copenhagen. Geophysical Section.
IONOSPHERIC RESEARCH USING SATELLITES Progress Report, 1 Sep. 1965–31 Aug. 1966
Asger N. Lunbak 30 Sep. 1966 7 p
(Contract AF 61(052)-828)
(PR-7; AFCRL-66-794; AD-642840) CFSTI: HC $3.00/MF $0.65

Unmodulated signals from Explorer 22 on 20, 40 and 41 Mc/s were recorded at three places in Denmark and Greenland. Both Faraday rotation and scintillation phenomena are very frequent in the records, so that ionospheric irregularities and total electron density can be studied in detail. The report presents a review of the activity in this respect. Author (TAB)

N67-21843# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE ANALYSIS OF CERTAIN PROBLEMS IN THE THEORY OF CHART CONSTRUCTION BY TRANSFORMATION OF LIGHT BEAMS USING THE PRINCIPLE OF DEFORMATION CORRECTION
T. S. Chang 15 Sep. 1966 29 p Transl. into ENGLISH from Ch'ing Hua ta Hsueh Hsueh Pao (Guozi Shudian), v. 7, no. 1, 1964 p 42–57
(FTD-TT-65-2016; TT-67-60503; AD-645833) CFSTI: HC $3.00/MF $0.65

There have been quite a few investigations on the theory of chart making by the transformation of light beams with the use of present day universal instruments. Basically, they may be summarized into two methods, namely the so-called two-fold decentration scheme and Zhukovs theory. This paper proceeds with a theoretical analysis of these two methods using the deformation correction principle followed by a study of the nature of the structural models of the two plans, their deformations and also the inherent relationships between the two. TAB

N67-21857# ARO, Inc., Arnold Air Force Station, Tenn.
SIMULATION OF CHEMILUMINESCENT REACTION OF NITRIC OXIDE WITH ATOMIC OXYGEN IN A SUPERSONIC LOW DENSITY WIND TUNNEL, PART 2 Technical Report, Mar. 14–Apr. 29, 1966
Jan A. van der Bliek and Robert A. Cassanova Arnold Eng. Develop. Center, Jan. 1967 28 p refs
(Contract AF 40(600)-1200)
(AEDC-TR-66-254; AD-645516) CFSTI: HC $3.00/MF $0.65

Low density wind tunnel tests were carried out at Mach 2 and 3 to simulate the release of nitric oxide in the upper atmosphere from a sounding rocket. The supersonic flow contained atomic oxygen, and the wall-less chemiluminescent reaction of O with NO was investigated. Reaction rate constants thus obtained were up to 5 orders of magnitude higher than previously obtained laboratory rate constants. Author (TAB)

14 INSTRUMENTATION AND PHOTOGRAPHY

Includes design, installation, and testing of instrumentation systems; gyroscopes; measuring instruments and gages; recorders; transducers; aerial photography; and telescopes and cameras.

N67-20461# Honeywell, Inc., Denver, Colo.
DEVELOPMENT OF GRAPHIC SIGNATURE RECORDER: A MILITARY DIRECT WRITING OSCILLOGRAPH
Harold J. Brikowski Dec. 1966 142 p
(Contract DA-28-043-AMC-00293(E))
(ECOM-00293-F; AD-644542) CFSTI: HC $3.00/MF $0.65

The report discusses the USA Signal Corps RO-278 oscillograph. It is a military version of the direct-write oscillograph capable of a wide variety of data recording applications. It contains three integral signal amplifiers with direct internal input to data recording galvanometers. It is capable of supplying identical data on two simultaneous records which can be separated at a perforation. Record speeds are 10, 40, and 80 ips with signal frequencies up to 13,000 cps. It contains an integral timer recording at 100 cps to an accuracy of 0.5%. It prints the record number, real time and date at the beginning of each record, and can be used to identify as many as 6 data modes with a function printer. The unit is emc qualified to MIL-I-6181D. All materials and components are military specification or qualified. A supplement is included which contains the program plan and personnel: project organization; support department functions; standards; drafting pool; technician pool; model maker pool; tech writing; reliability; and key personnel.
Author (TAB)

N67-20582# Naval Radiological Defense Lab., San Francisco, Calif.
A STANDARDIZED METHOD FOR MAKING NEUTRON FLUENCE MEASUREMENTS BY FISSION FRAGMENT TRACKS IN PLASTICS
S. Pretre, Eugene Tochilin, and Norman Goldstein 19 Oct. 1966 32 p refs
(USNRDL-TR-1089; AD-643540) CFSTI: HC $3.00/MF $0.65

A neutron detector is described which consists of a fission foil (232Th, 235U, 238U, 237Np or 239Pu) in contact with a plastic track detector. These detectors were exposed to reactor neutrons and to monoenergetic neutrons with energies between 1.0 - 18 MeV. Fission fragment tracks registered in the plastic were selectively etched by an hydroxide and counted in an optical microscope. For thick foils of fissionable metals the sensitivity of the system was found to be (1.16 plus or minus 3%) X 10 to the minus 5:th power fission fragment tracks/neutron - barn which is in good agreement with theoretical calculations. This sensitivity is independent of the fissionable element used, independent of the neutron energy, fairly independent of the material chosen for track registration (plastics, glass, mica) and of etching conditions. Since the (n,f) cross sections are accurately known for most neutron energies, the above constant can also be used for standardized measurements of neutron fluences. TAB

N67-20600# Texas Instruments, Inc., Dallas. Science Services Div.
LASA DATA ANALYSIS AND MCF SUPPORT Final Report
Harry Lake, George Hair, Don Crouch, Bill Johnson, Terry Harley et al 31 Aug. 1966 272 p Prepared for MIT
(Contract AF 19(628)-5167; ARPA Order 512; Proj. Vela Uniform)
(ESD-TR-66-552; AD-642403) CFSTI: HC $3.00/MF $0.65

With the objective of determining optimum design criteria for predetection multichannel filters for use at the subarray level at the LASA, a study was conducted of the characteristics of the ambient noise fields and instrument responses of five selected subarrays. Based on the measured characteristics of the noise fields and instrument responses, 14 multichannel filters were developed and compared as to degree of improvement in signal-to-noise ratio. A multichannel filter, of a design determined by the comparison experiments to be optimum for subarray predetection filtering, was developed for each of five subarrays. Five multichannel filters of a slightly different design also were developed. These multichannel filters, and certain others of interest, were punched on paper tape for on-line evaluation with the Digital Multichannel Filter System at LASA. A processing procedure for detecting signals at either subarray or full-array level is recommended and illustrated by application to selected events at those subarrays under consideration.
Author (TAB)

N67-20633# Aeronautical Chart and Information Center, St. Louis, Mo. Linguistic Section.
MARINE GRAVIMETER WITH PHOTOELECTRIC MICROMETER [MORSKOY GRAVIMETR S FOTOELEKTRICHESKIM MIKROMETROM]
Ye. I. Popov and V. A. Tulin [1966] 27 p refs Transl. into ENGLISH from the book "Apparatura i Metody Morskikh Gravimetricheskikh Nablyudeniy" (Moscow), Izd. Nauka, 1965 p 3–17
(ACIC-TC-1114; TT-67-60081; AD-642792) CFSTI: HC $3.00/MF $0.65

The article describes the first model of the instrument for measuring the gravity acceleration from a ship. The device is a quartz gravimeter with liquid thermal compensation data units based on the utilization of the elastic properties of wound wire. The elastic system (data unit for the change of gravity acceleration) consists of a quartz frame to which a thin (about 100mcm) quartz wire is attached. A pendulum with a mirror 1 is soldered to the center of the wire. The momentum created by the pendulum winds up the wire to an angle of 300-500 degrees. TAB

N67-20711# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
MINIATURE SEMICONDUCTOR PRESSURE SENSOR
L. A. Osipovich and I. I. Smyslov 29 Aug. 1966 7 p refs Transl. into ENGLISH from Priborostroenie (Moscow), no. 10, 1965 p 24–25
(FTD-HT-66-314; TT-67-60246; AD-643931) CFSTI: HC $3.00/MF $0.65

It is concluded that the application of strain-gauge elements made from dendritic germanium foil for miniature pressure sensors is very promising because these strain-gauge elements can be made minimally small, for example, 1.5 - 2 mm long, 0.2 - 0.3 mm wide and 0.15 - 0.2 mm thick, and even smaller. Author (TAB)

N67-20728# Texas Instruments, Inc., Dallas.
GROUND-TRUTH RESEARCH FOR AN AIRBORNE MULTISENSOR SURVEY PROGRAM Final Report
R. Ludlum 1 Nov. 1966 98 p refs
(Contract N00014-66-C0049)
(AD-641894) CFSTI: HC $3.00/MF $0.65

The program involved (1) the testing of the applicability of the Barnes Engineering Company Model PRT 14-313 portable infrared thermometer to ground-truth measurement operations and (2) investigation of the influence of variations in sky conditions and radiometer aspect angles on radiometric temperatures and emissivity factors. Findings show that the PRT 14-313 radiometer

is usable in ground-truth procedures but that design limitations very seriously reduce its effectiveness. Analysis of empirical data indicates that radiometric temperatures of foliage are more a function of environmental conditions than of sky conditions, radiometer aspect angles or leaf orientations. On samples of asphalt, concrete and soil surfaces, however, the influence of variations in sky conditions and aspect angles on radiometric temperatures is quite pronounced, and it is recommended that any attempts at emissivity determinations be conducted under clear sky at night with aspect angles near normal incidence, if possible, but in no case at aspect angles less than 50 degrees. Author (TAB)

N67-20763# Iowa State Univ. of Science and Technology, Ames.
MAGNETIC FLOWMETER CALIBRATION
Delwyn D. Bluhm, Dale L. Smith, and R. W. Fisher Aug. 1966 45 p refs
(Contract W-7405-ENG-82)
(IS-1203) CFSTI: HC $3.00/MF $0.65

A direct current magnetic flowmeter was accurately calibrated both theoretically and experimentally for measuring the flow rate of 100 to 500°C liquid sodium in 3/4 in. schedule 40 Inconel 600 pipe. A theoretical calibration factor, Y_{TH}, was computed for sodium loop temperatures from 100 to 600°C. An experimental calculation factor, Y_{EXP}, was determined for sodium magnet temperatures from 143 to 527°C. Before determining the factor Y_{EXP}, it was necessary to measure accurately the flowmeter magnetic field with a light-beam-ty/e fluxmeter for magnet temperatures from 20 to 100°C. Accurate measurements of sodium flow rate were made with an Inconel venturi meter which was designed for a maximum flow rate of 15 gpm with a differential heat of 48 in. of sodium at this maximum flow rate. Water and the weigh tank method of calibration were used to calibrate the venturi meter. The differential pressure between inlet and throat of venturi meter was measured by manometer columns and differential transformers. An Engineering Sodium Test Loop was used for the experimental calibration of the magnetic flowmeter. The experimental accuracy of this work is better than 1%. The theoretically predicted value of the calibration factor was always found to be within at least 3% of the experimentally determined value. Author (NSA)

N67-20792# California Univ., Berkeley. Lawrence Radiation Lab.
HIGH RESOLUTION BETA-RAY AND GAMMA-RAY SPECTROMETER
Emanuel Elad and Michiyuki Nakamura 27 Sep. 1966 23 p refs Presented at the IEEE 13th Ann. Nucl. Sci. Symp., Boston, 19-21 Oct. 1966
(Contract W-7405-ENG-48)
(UCRL-17149; CONF-661020-10) CFSTI: HC $3.00/MF $0.65

A high-resolution semiconductor beta and gamma spectrometer is described. The spectrometer consists of a silicon or germanium detector, low-noise field-effect transistor pre-amplifier, and a linear amplifier. The requirements for the different sections for high-resolution performance are outlined. NSA

N67-20800# Edgerton, Germeshausen and Grier, Inc., Las Vegas, Nev.
SOME REMARKS ON CHRONOTRON ALPHA METER
R. D. Hansen and J. W. Sedlmeyer 20 Oct. 1966 20 p refs Presented at the 13th Ann. Nucl. Sci. Symp., Boston
(Contract AT(29-1)-1183)
(EGG-1183-1285; CONF-661020-3) CFSTI: HC $3.00/MF $0.65

The Chronotron Alpha Meter is an instrument developed to measure the time difference between two discrete levels of a pulse to an accuracy of a few picoseconds. The instrument output is a dc level which corresponds to this time difference. This instrument has been used to measure the rate of rise of fast single transient waveforms such as the exponent, alpha (α), of a positive exponential signal of the form $E = E_0 e^{\alpha t}$. Other typical applications such as measuring time interval between pulses, linearity of ramps and the rise rate and shape of any continuously rising analytical functions are discussed. Author (NSA)

N67-20809# Atomic Energy Establishment, Winfrith (England). Reactor Development Div.
A MULTI-CHANNEL, FAST SCANNING, RECORDER
D. J. Adnams, K. J. Salt, and C. A. Wintle May 1966 20 p
(AEEW-R-486) HMSO: 5s 6d

The design of a fast-scanning instrument which measures the outputs from 216 thermocouples every 5 seconds, records them individually on a chart and provides alarm facilities is reported. Author (NSA)

N67-20904# Sandia Corp., Albuquerque, N. Mex.
ELECTROMECHANICAL REMOTE POSITION SENSOR
W. F. Windle Jul. 1965 22 p
(Contract AT(29-1)-789)
(SC-TM-65-289) CFSTI: HC $3.00/MF $0.65

A feasibility study of an electromechanical remote position sensor intended for the remote setting of an electro-mechanical timer is discussed. The position sensor uses a transistor voltage comparison circuit to compare resistance (and thus mechanical position) of two 10-turn pots in a resistance bridge. Two variations of the resistance bridge, and two variations of the voltage comparison circuit are presented. Author (NSA)

N67-20912# Gosudarstvennyi Komitet po Ispolzovaniyu Atomnoi Energii, Obninsk (USSR). Fizikoenergeticheskii Institut.
A METHOD OF STABILIZATION OF SCINTILLATION SPECTROMETERS [METOD STABILIYATSII STSINTIL-LYATSIONNOGO SPEKTROMETRA]
V. N. Kononov, A. A. Metlev, and V. S. Shorin 1966 12 p refs In RUSSIAN
(FEI-37) CFSTI: HC $3.00/MF $0.65

Following a brief discussion of various problems of scintillation spectrometer stabilization, a digital stabilization system of a multichannel analyzer based on the differential counting rate is described. The reference peak is produced by a light flash generator which uses a glow thyratron. The pulsed light source has no statistical spread of pulse amplitudes and allows placement of the reference peak in any energy region of the spectrum. The light signals are accompanied by generator pulses making anticoincidence arrangements possible. The reference pulse amplitude drift is suppressed by a self-stabilized generator with negative feedback which is also described in detail. A test comparison of the counting rate of the eighty-first and eighty-third analyzer channel with a 15 v bias was carried out with a 250 c/sec load in the peak and a 60 c/sec rate in the reference channels; the amplitude of the light flash corresponded to 10 Mev with a 3% half-width; the stabilization factor was 35. NSA

N67-20934# Atomic Weapons Research Establishment, Aldermaston (England).
LARGE VOLUME LITHIUM DRIFTED GERMANIUM DIODES FOR γ RAY SPECTROSCOPY
A. H. F. Muggleton Oct. 1966 20 p refs
(AWRE-NR-3/66) HMSO: 3s

Coaxial, lithium drifted germanium diodes with sensitive volumes greater than 17 cc were manufactured and tested as γ ray spectrometers. Detailed fabrication techniques are described together with details of detector performance. Author (NSA)

N67-20959# European Atomic Energy Community, Ispra (Italy). Engineering Dept.
REVERSIBLE DECIMAL COUNTERS [CONTATORI DECIMALI REVERSIBILI]
G. Battistelli Aug. 1966 14 p refs In ITALIAN
(EUR-3062.I)

A general analysis of a decimal scaler obtained from four binaries controlled by logic gates is described. The method to find the boolean equations that determine their behavior is shown. Some types of reversible counters developed in the electronic laboratory are compared with regard to cost and number of components. Author (NSA)

N67-20968# Joint Inst. for Nuclear Research, Dubna (USSR).
SPACE COORDINATE RECONSTRUCTION OF TRACK POINTS BY TWO STEREOPROJECTIONS [VOSSTANOVLENIE PROSTRANSTVENNYKH KOORDINAT TOCHEK TREKOV PO DVUM STEREOPROEKTSIYAM]
I. M. Ivanchenko, N. A. Krutkova, V. I. Moroz, T. G. Ostanevich, and G. N. Tentyukova 1966 16 p refs In RUSSIAN
(JINR-P-2889)

By the least squares method the formulas were obtained of space coordinate reconstruction of points by two stereoprojections for the case of photography with the parallel axis cameras. The formulas obtained result in much smaller dispersions of space coordinates of the corresponding points, especially for the regions near to stereobasis. The formulas described were successively used in a number of programs of a geometrical reconstruction, worked out in the JINR. Author (NSA)

N67-21045# Reactor Centrum Nederland, Petten.
FOCUSING OF A TRIPLE-AXIS NEUTRON SPECTROMETER WITH THE AID OF GRAPHICAL METHOD
J. Bergsma and C. Van Dijk *In* Brookhaven Natl. Lab. Inelastic Scattering of Neutrons by Condensed Systems Mar. 1966 p 163–168 refs (See N67-21022 10-24) CFSTI: HC $3.00/MF $0.65

The theory of focusing a triple-axis neutron spectrometer for the study of inelastic neutron scattering in crystals is discussed. From its definition, i.e., incoming neutrons which exhibit a certain wave vector spread are scattered inelastically by the same phonon (or magnon) with one scattered wave vector, and conversely outgoing neutrons, which leave the analyzer crystal with a wave vector spread, arising from one wave vector, the focusing conditions for a triple-axis spectrometer are derived analytically. The loci of vectors can easily be constructed. From the resulting graphs it is often possible to select a combination of incoming and scattered wave vectors which define the observation of a particular phonon. In this way the focusing parameters for the triple-axis spectrometer are found rather directly. The method shows also quite clearly the experimental limitations for operation of the triple-axis spectrometer under focused conditions. Author (NSA)

N67-21049# India. Dept. of Atomic Energy, Bombay.
TROMBAY MULTIARM SPECTROMETER
P. K. Iyengar *In* Brookhaven Natl. Lab. Inelastic Scattering of Neutrons by Condensed Systems Mar. 1966 p 179–182 refs (See N67-21022 10-24) CFSTI: HC $3.00/MF $0.65

The spectrometer described has a monochromator providing neutrons of readily variable energy and up to five analyzing spectrometers which examine the sample distributed in the range of scattering angles from +120 to −90°. The design follows that of a triple-axis spectrometer, and the motion of different arms and the incident energy are controlled by electromechanical automation. This instrument is mainly used for studying phonon energies in crystal lattices simultaneously at different points in reciprocal space. NSA

N67-21063 Kernforschungsanlage, Juelich (West Germany). Institut fuer Neutronenphysik.
INVESTIGATION OF THE MASS SPECTROMETRY DECOMPOSITION OF FISSION PRODUCTS [UNTERSUCHUNG UEBER DIE MASSENSPEKTROMETRISCHE TRENNUNG VON SPALTPRODUKTEN]
P. Armbruster and H. Lawin Jan. 1965 33 p refs In GERMAN
(JUL-248-NP) CFSTI: $3.00

Discussed is the resolving power of mass spectrographs in obtaining impurity free spectral separations in energy distribution analyses of nuclear fission products. Various mass spectrographs suitable for nuclear fission separation are evaluated and compared with each other. It is found that parabola spectrographs possess a 10 times greater intensity value for fast unlimited fission product studies than double focusing mass spectrographs; the latter require pre-refraction of direct radiation emitting from the reactor core to focus the stigmatic image bundle and thus contain a certain resolving intensity loss. Transl. by G.G.

N67-21169 Joint Publications Research Service, Washington, D. C.
RASTER OPTICAL INSTRUMENTS
N. A. Valyus 14 Feb. 1967 15 p Transl. into ENGLISH of the book "Rastrovyye Opticheskiye Pribory" Moscow, 1966 p 62–69, 206–207
(JPRS-39893; TT-67-30541) CFSTI: HC $3.00

Various types of raster screens, and rasters for projection in an illuminated room are described. The size, shape, and arrangement of raster elements for different purposes are mentioned for the mirror raster, mirror prism, reflecting lens raster, translucent lens raster, and collecting lens raster systems. Details are presented on reflecting and translucent screens and the resulting paths of light rays for projection in the daylight or in an illuminated auditorium. N.E.N.

N67-21204# Aeronautical Research Council (Gt. Brit.)
THE RESPONSE TIMES OF TYPICAL TRANSDUCER-TUBE CONFIGURATIONS FOR THE MEASUREMENT OF PRESSURES IN HIGH-SPEED WIND TUNNELS
M. J. Larcombe and J. W. Peto 1966 50 p refs Supersedes NPL-AERO-1157; ARC-27105; See X66-13372
(ARC-CP-913; NPL-AERO-1157; ARC-27105) CFSTI: HC $3.00/MF $0.65

Existing theories are extended to obtain the response time for low pressures with slip flow in a compound tube system. The theory provides a useful estimate of the response time even when the volume of the measuring instrument falls to zero. Comprehensive experimental data are presented for a range of tube configurations, including a flush-diaphragm pressure transducer, suitable for applications in high-speed wind tunnels. An Appendix provides some notes on the design of a pressure-measuring system incorporating a pressure-scanning switch. Author

N67-21216# Kernforschungsanlage, Juelich (West Germany). Institut fuer Physikalische Chemie.
COMPARATIVE INVESTIGATIONS OF COUNTING METHODS FOR THE ABSOLUTE DETERMINATION OF ALPHA RAYS [VERGLEICHENDE UNTERSUCHUNGEN UEBER ZAEHLMETHODEN ZUR ABSOLUTBESTIMMUNG DER AKTIVITAET VON ALPHA-STRAHLERN]
H. Ilhe, M. Karayannis, and A. Murrenhoff Sep. 1965 76 p refs In GERMAN; ENGLISH summary
(JUL-298-PC) CFSTI: HC $3.00/MF $0.65

With the aim of improving precision and avoiding systematic errors in absolute counting of α-emitters, a comparative investigation of (1) 4π-counting with liquid scintillators, and (2) 4π-proportional

counting has been carried out. The measures necessary to avoid the sources of error have been studied. Conditions have been found under which agreement of the results of both methods can be achieved within a few tenths of a percent. A device for non-destructive testing of the electrical conductivity of the extremely thin foils used on 4π-source carriers is described. Author

N67-21258# Israel Program for Scientific Translations, Ltd., Jerusalem.

INTRODUCTION OF LEVEL GAGES INTO NONFERROUS METALLURGY

V. V. Sevast'yanov, I. M. Likhterov, V. N. Petukhov, B. P. Sharman, V. K. Fedotov et al *In its* The Uses of Radioact. Isotopes and Nucl. Radiation in the U.S.S.R. Vol. III: Machine Bldg., Met. 1966 p 163–166 (See N67-21221 10-15) CFSTI: HC $3.00/MF $0.65

Level gauges that employ a cobalt 60 gamma source are installed in bins and other containers in an industrial plant dealing with nonferrous metallurgical processes. Installation techniques for these gamma relays are noted, and some experiences are reported for the gauges that permit automation of the following operations: (1) determining presence of sufficient material in the bins, (2) serving as conveyers for loading the ore bins, and (3) monitoring bins of mixed charge and fine coke in charge-mixing operations. Automation is reported to improve the quality of the manufactured agglomerate. M.W.R.

N67-21259# Israel Program for Scientific Translations, Ltd., Jerusalem.

INTRODUCTION OF RADIOMETRIC DENSITY GAGES AT THE MIZUR ORE-DRESSING PLANT

E. Ya. Ovcharenko, U. I. Kotik, L. I. Fainberg, G. V. Tuev, and V. V. D'yakonenko *In its* The Uses of Radioact. Isotopes and Nucl. Radiation in the U.S.S.R. Vol. III: Machine Bldg., Met. 1966 p 167–169 (See N67-21221 10-15) CFSTI: HC $3.00/MF $0.65

Industrial testing and use of radiometric density gauges are discussed in terms of control of pulp density and corrosive liquids at nonferrous metallurgical establishments. Investigations revealed a sharp decrease in errors when higher energies of cobalt 60 gamma radiation was used. Use of cesium gamma sources revealed errors of more than 2%, and cesium was considered applicable only if there were no elements of high atomic numbers in the controlled medium. The described radiometric gauge is considered useable in hydrometallurgical shops, for the production of titanium, magnesium, and other metals where corrosive media are involved; and for ferrous metallurgy, chemical, and coal establishments. M.W.R.

N67-21260# Israel Program for Scientific Translations Ltd., Jerusalem.

NONCONTACT CONTROL OF IRON-ORE PULP DENSITY

A. K. Val'ter, M. L. Gol'din, and I. N. Plaksin *In its* The Uses of Radioact. Isotopes and Nucl. Radiation in the U.S.S.R. Vol. III: Machine Bldg., Met. 1966 p 170–176 (See N67-21221 10-15) CFSTI: HC $3.00/MF $0.65

Economic advantages are noted for the installation of noncontact cesium 137 radioactive density gauges and other control instruments to determine iron ore pulp density. The measuring circuit of the density gauge is shown, and the design and installation of the gauge are described. Mention is made of laboratory, pilot-plant, industrial testing of the gauge. A reliable design of the overflow trough was devised, and variations in the pulp density are shown over this overflow trough. M.W.R.

N67-21270# Israel Program for Scientific Translations, Ltd., Jerusalem.

COUNT-TIME AUTOMATIC RADIATION METER

V. N. Afanas'ev *In its* The Uses of Radioact. Isotopes and Nucl. Radiation in the U.S.S.R. Vol. III: Machine Bldg., Met. 1966 p 206–207 (See N67-21221 10-15) CFSTI: HC $3.00/MF $0.65

Development and operation studies of count-time autoradiometers indicate their feasibility for the control and monitoring of technological parameters and experimental apparatus. Measurements are made by counting pulses, thereby making it possible to record radiation intensities of any size. Since all measurements require the counting of the same number of pulses, the statistical error is considered to remain the same. These automatic radiation meters can be devices with continuous and discrete recording, with logarithmic and hyperbolic scales, and with multichannel consecutive or parallel recording. Simplified design of the counting unit is recommended for the future research programs. M.W.R.

N67-21271# Israel Program for Scientific Translations, Ltd., Jerusalem.

THICKNESS GAGE FOR MEASURING HOT-ROLLED PRODUCTS

B. N. Vasichev, V. K. Latyshev, Yu. S. Pilakin, A. K. Felinger, A. A. Lyubchenko et al *In its* The Uses of Radioact. Isotopes and Nucl. Radiation in the U.S.S.R. Vol. III: Machine Bldg., Met. 1966 p 208–210 (See N67-21221 10-15) CFSTI: HC $3.00/MF $0.65

A thickness gauge for measuring hot-rolled products between 14 and 44 mm is based on dynamic compensation. A radiation detector is used by the gauge, and a water-cooled container protects the personnel who use the instrument. Measurement is accomplished by scanning the entire range, with a null element marking the moment at which the measured quantity becomes equal to the reference parameter. Accuracy of the instrument is estimated at ±0.1 mm over the entire range, and its working capability is one measurement per second. M.W.R.

N67-21274# Israel Program for Scientific Translations, Ltd., Jerusalem.

RADIOMETRIC HOMING LEVEL GAGE FOR BLAST FURNACES

V. E. Afanas'ev, I. G. Polovchenko, and C. G. Smirnov *In its* The Uses of Radioact. Isotopes and Nucl. Radiation in the U.S.S.R. Vol. III: Machine Bldg., Met. 1966 p 218–219 (See N67-21221 10-15) CFSTI: HC $3.00/MF $0.65

A homing level gauge is described that has two sources of hard gamma radiation installed on opposite sides of the charge hole of a blast furnace, and can continuously monitor the level of materials in the furnace. Operating principle of the gauge is outlined, and mention is made of its advantages over currently used mechanical probes. M.W.R.

N67-21318# Israel Program for Scientific Translations, Ltd., Jerusalem.

SCINTILLATION EMANOMETERS

S. S. Lenin *In its* The Uses of Radioactive Isotopes and Nucl. Radiation in the U.S.S.R., Vol. 4 1966 p 308–311 (See N67-21281 10-13) CFSTI: HC $3.00/MF $0.65

Brief descriptions are presented on a commercial sample of a field scintillation emanometer, as well as a laboratory apparatus for radiochemical analyses. The emanometer is designed for field emanation surveys and for determining the concentration of emanation in air for dosimetric purposes. With a special attachment, it can be used for recording alpha radiation from powder samples.

Performance is based on scintillation counts produced by the alpha particles emitted by emanation and the products of their disintegration on the chamber walls which are coated with the phosphor ZnS(Ag). The use of scintillation counters in apparatus for radiochemical analyses is also discussed. Author

N67-21326# ARO, Inc., Arnold Air Force Station, Tenn.
VACUUM MEASUREMENTS BY TIME-OF-FLIGHT MASS SPECTROMETRY Technical Report, May 1, 1965–May 6, 1966
F. G. Sherrell and A. J. Mathews Arnold Eng. Develop. Center, Oct. 1966 33 p refs
(Contract AF 40(600)-1200)
(AEDC-TR-66-150; AD-800436) CFSTI: HC $3.00/MF $0.65

Procedures are discussed for using mass spectrometers to make absolute partial pressure measurements of complicated residual gas mixtures in high vacuum systems. The details of the matrix inversion technique and an interaction procedure for calculating partial pressure from mass spectrometer data are presented. Performance of a Bendix Model 17-210V time-of-flight mass spectrometer and calibration data obtained are given. These data indicate that short-term instrument stability cannot be assumed for mass spectrometers which use electron multipliers for ion detection, and that instrument linearity can be assumed only under certain operating conditions. The data show that frequent, in-place, mass spectrometer calibrations are necessary. The matrix inversion technique and the iteration procedure were evaluated experimentally by reducing the 17-210V spectrum of a 12-component mixture of common residual gases whose partial pressures were known. The experimental results indicate that the iteration technique is the simplest to apply, and that it produces more accurate partial pressure solutions. It is concluded that accuracies of plus or minus 15 percent in partial pressure measurements are obtainable. Author (TAB)

N67-21339# Technical Operations Research, Burlington, Mass.
INVESTIGATION OF ELECTRONIC FRINGE DETECTOR FOR A STELLAR INTERFEROMETER
John Boardman, Paul Kellen, and Diana Nyyssonen 7 Nov. 1966 90 p refs
(Contract AF 19(628)-5145; ARPA Order 450)
(TO-8-66-91; AFCRL-66-767; SR-1; AD-644243) CFSTI: HC $3.00/MF $0.65

A fringe detector was constructed to detect fringes from a Michelson stellar interferometer and to relate these measurements to the characteristics of the source of illumination. This instrument has variable separation apertures adjustable from 0.6 to 6 cm. Aperture height is maintained at 0.1 times the separation. An optical system produces the fringe pattern by superimposing the partially coherent light entering the two apertures. A rotating reflector, single slit, and phototube combine to transform the spatially varying intensity pattern of the fringe field into a time-varying voltage signal displayed on an oscilloscope face. The oscilloscope trace is photographed and analyzed to determine fringe contrast. The maximum sensitivity of the detector was determined to be equivalent to a source providing 10 to the minus 10th power watts/sq cm at a fringe contrast of 1 and a signal-to-noise ratio of 1. Improvements in the entrance aperture configuration, phototube sensitivity, and the use of a grating instead of a single slit can provide a factor of 500 to 1000 improvement in detector sensitivity. The interferometer was determined to have potentially better resolution than a single-mirror telescope because it can electrically filter the effects of ambient background illumination and turbulence. The use of an interferometer to measure the angular size of a pie-shaped source was studied and found to be not particularly suited to this purpose. Author (TAB)

N67-21387# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
SEMICONDUCTOR NUCLEAR PARTICLE COUNTERS
S. M. Ryvkin, O. A. Matveyev, and N. B. Strokan 16 Aug 1966 57 p refs Transl. into ENGLISH of the book "Poluprovodnikovyye Schetchiki Yadernykh Chastits, Vypusk 10" Leningrad, 1964 p 1–40
(FTD-MT-65-138; TT-67-60286; AD-644024) CFSTI: HC $3.00/MF $0.65

Contents: Contemporary Spectrometric n-p Counters; and Possibilities of Use of Homogeneous Semiconductors as Counters. TAB

N67-21378# Army Electronics Labs., Fort Monmouth, N. J. Electronic Components Lab.
SIMPLE ELECTRICAL TRANSIENT DETECTOR
Dennis Bowman Nov. 1966 13 p
(ECOM-2776; AD-644834) CFSTI: HC $3.00/MF $0.65

The report describes a simple, inexpensive device designed for measuring electrical transients encountered in both vehicular and aircraft power supplies. It is adaptable particularly for measuring electrical disturbances which might be encountered under dynamic operating field conditions. By analyzing the results reported by this device, factors affecting both the power supply and integrated electronic equipment might be encountered. Author (TAB)

N67-21379# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
PIEZOELECTRIC TRANSDUCER OF ACCELERATION
P. M. Alabuzhev, P. I. Ostromenskiy and V. F. Khon 9 Sep 1966 6 p refs Transl. into ENGLISH from Soviet Patent no. 171678 (Appl. no. 894836/25-28, 9 Apr. 1964) 2 p
(FTD-HT-66-108; AD-644041) CFSTI: HC $3.00/MF $0.65

The object of the invention is a piezoelectric transducer of acceleration, which contains a piezoelectric element rigidly fastened to a body, an inertial mass and a recording apparatus. To simplify the design the piezoelectric element is made in the form of a spherical shell from a piezoceramic with a metallic external surface and this shell is filled with an electrical conducting fluid, which is simultaneously the inertial mass and the internal electrode of the piezoelectric element. Author (TAB)

N67-21388*# Israel Program for Scientific Translations, Ltd., Jerusalem.
INSTRUMENTS AND APPARATUS FOR PRESSURE MEASUREMENT
In its Wind Tunnels and Their Instrumentation 1966 p 255–325 refs (See N67-21381 10-11) CFSTI: HC $3.00/MF $0.65

For application to pressure measurement of motion in a liquid or gas, scientific instrumentation is examined. Various types of manometers, used to measure gage pressure, are discussed. Of the liquid-column manometers, two types are specified: manometers for direct reading, and manometers of the null type. Technical details and pertinent graphics are also presented on such manometers as: U-tube manometers, well-type, liquid-column, mechanical, spring-type, force-compensation, multiple, and micromanometers. Also detailed are: electrical pressure transducers, inductive transducers, and capacitive transducers. Some emphasis is placed on the transmission lag in manometric systems. R.U.

N67-21390*# Israel Program for Scientific Translations, Ltd., Jerusalem.
AUTOMATIC DATA RECORDING AND PROCESSING OF WIND-TUNNEL MEASUREMENTS

In its Wind Tunnels and Their Instrumentation 1966 p 564–592 refs (See N67-21381 10-11) CFSTI: HC $3.00/MF $0.65

To speed up research and design operations of aviation and rocket technology, fast-operating automatic computers were developed. A block diagram is presented on an electronic digital computer, while a brief comparison is made of analog and digital computers. Graphical and numerical methods of automatically recording primary measurements from wind tunnel tests are indicated. The recording of digital data in wind tunnels envisages two operations: conversion of the measured signals into digital or binary form, and the storing of the numbers representing the measure values in a short-term memory (register), from which the digits are rewritten onto special forms. The simplest device for continuously registering angular movements in digital form is a mechanical counter. Graphics depict the apparatus for processing the measured data on both analog and digital computers. R.Ll.

N67-21423# Ballistic Research Labs., Aberdeen Proving Ground, Md.

STILBENE SPECTROMETER FOR NEUTRONS AND GAMMAS: ELECTRONICS AND RELATED PERFORMANCE

Konrad Frank Sep. 1966 165 p refs

(BRL-R-1335; AD-644448) CFSTI: HC $3.00/MF $0.65

The instrumentation package of a spectrometer system for neutrons and gamma rays is discussed in detail. The pulse signals produced in stilbene crystal by neutrons and gamma rays are stored simultaneously in different memory subgroups of a multichannel analyzer by using pulse shape discrimination techniques. Neutrons in the energy range from 0.5 MeV to 20 MeV and gamma rays in the energy range from 0.15 MeV to 11 MeV are analyzed with a discrimination ratio exceeding 1000:1. The lower energy discrimination limit of the system is 22 keV electron energy which corresponds to 270 keV neutron energy and 90 keV gamma ray energy. Author (TAB)

N67-21471# Florida State Univ., Tallahassee.

A SYSTEM FOR MEASURING FAST SCINTILLATION DECAY TIMES

David Ronald Fannin (M.S. Thesis) Aug. 1966 47 p refs

(Contract AT(40-1)-3349)

(ORO-3349-2) CFSTI: HC $3.00/MF $0.65

The considerations involved in the design, construction, and the calibration of a system for measuring fast scintillation decay times are described. Results of measurements on several scintillators are reported. Excitation was primarily by means of α particles. NSA

N67-21494# Comitato Nazionale per l'Energia Nucleare, Rome (Italy).

MEASUREMENTS OF LARGE MAGNETIC FLUX DERIVATIVES BY MEANS OF A CLOSED RESISTIVE LOOP

C. Bartoli and R. Gratton 1966 10 p

(RT/FI/66/-3)

A method to measure magnetic flux derivatives through large areas, avoiding high voltages in the circuit, is described. A brief circuit analysis and practical construction data for a typical situation are given. Author (NSA)

N67-21508# Massachusetts Inst. of Tech., Cambridge. Lab. for Nuclear Science.

LARGE TRANSMISSION, MAGNETIC, HEAVY-PARTICLE SPECTROMETER WITH GOOD RESOLVING POWER

Donald L. Smith and Harald A. Enge Oct. 1966 36 p refs *In its* Lab. for Nucl. Sci. Tech. Rept. No. 79

(Contract AT(30-1)-2098)

(MIT-2098-276) CFSTI: HC $3.00/MF $0.65

A method for adapting a broad-range magnet for large solid angle, high-resolution spectrometry is described. The instrument uses a preceeding magnetic quadrupole lens to increase the collecting power of the instrument. The median plane of the magnet is normal to the reaction plane. Correction for Doppler broadening is obtained, to first order, by rotating the quadrupole lens about its axis. The instrument is first adjusted to yield a stigmatic image of a monochromatic source at the detector slits. When there is Doppler broadening, the quadrupole lens is rotated yielding an astigmatic image of the source. A point source focuses to a narrow line. This is an advantage because then the large tranverse magnification does not affect the sharpness of the line (resolving power) but only its length. NSA

N67-21532# Kernforschungsanlage, Juelich (West Germany). Institut fuer Plasmaphysik.

DEVELOPMENT OF A SHORT-TIME CAMERA OF HIGH RESOLUTION WITH THE ORTHIKON IMAGE [DIE ENTWICKLUNG EINER KURZZEITKAMERA HOHER AUFLOESUNG MIT DEM IMAGE-ORTHIKON]

W. Hopmann Aug. 1966 73 p refs In GERMAN; ENGLISH summary

(JUL-290-PP)

The development of a high speed still camera is described, which uses the Image Section of an Image–Orthicon Television Camera Tube as high speed photoelectronic shutter. The general problems of using TV-apparatus in high speed photography are discussed. A commercially manufactured closed circuit TV-system was modified for single frame scanning. These modifications and the auxiliary circuits are described. The effects of high electron currents in the image section at very short exposure times are estimated and compared with experimental results. The shutter efficiency of the image section is mainly determined by photoelectric emission of the target foil, the reasons of that emission are discussed. Author (NSA)

N67-21533# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems.

NMR MAGNETIC FIELD DISCRIMINATOR AND AUTOMATIZATION OF MAGNETOMETER OPERATION [YAMR DISKRIMINATOR MAGNITONOGO POLYA I AVTOMATIZATSIYA RABOTY MAGNITOMETRA]

V. M. Lachinov 1966 18 p refs In RUSSIAN

(JINR-P9-3014)

The NMR discriminator of the magnetic field with the modulation amplitude, which exceeds the NMR width of a line, is described. A scheme is presented in which the discriminator is used to realize locking of the magnetometer to the measured field with an accuracy better than 10^{-5}. A possibility of complete magnetometer automatization in each of its subbands is considered. Author (NSA)

N67-21541# Commissariat a l'Energie Atomique, Saclay (France). Services d'Etudes sur la Separation des Isotopes de l'Uranium.

TRIALS CARRIED OUT ON CORROSIVE (FLUORINATED) ATMOSPHERE GAGES [ESSAIS DE PROTOTYPES DE JAUGES A VIDE POUVANT TRAVAILLER ATMOSPHERE CORROSIVE (FLUOREE)]

Madeleine Constant, Alain Houyvet, and Pierre Noe Nov. 1966 11 p In FRENCH

(CEA-R-3055)

A study of the stability of readings given by a modified Pirani type measurement probe with a view to long term operation in the presence of corrosive gases is discussed. Results of measurements carried out before and after use under these conditions are presented. Author (NSA)

N67-21572# Deutsches Elektronen-Synchrotron, Hamburg (West Germany).

AN AUTOMATIC APPARATUS FOR SURVEYING SPARK CHAMBER PICTURES [EIN AUTOMATISCHES GERAET ZUR AUSMESSUNG VON FUNKENKAMMERBILDERN]

U. Becker, K. Hoehne, and J. Weber Sep. 1966 26 p refs In GERMAN; ENGLISH summary
(DESY-66/25)

An automatic device for the measurement of spark chamber pictures is described. Using the flying spot technique, it measures 24×36 mm pictures on reversal film in 8 sec per frame. The accuracy of a single digitization in the direction parallel to the spark chamber plates is ±10 μm; in the perpendicular direction the accuracy is better than ±36 μm. It is shown that with three digitizations per spark the accuracy of the device considerably exceeds that of hand measurements. The hardware components are described and the performance of the apparatus is discussed in detail. Author (NSA)

N67-21583# Akademiya Nauk SSSR, Novosibirsk. Institut Yadernoi Fiziki.

SYSTEM FOR ULTRAFAST REGISTRATION OF SPECTRAL LINE SHAPES [SISTEMA DLYA SVERKHSKOROSTNOI REGISTRATSII KONTUROV SPEKTRAL'NYKH LINII]

E. P. Kruglyakov and Yu. E. Nestrikhin 1966 14 p refs In RUSSIAN
(NP-16394) CFSTI: HC $3.00/MF $0.65

The characteristics of a modernized double converter spectrometer for ultrafast registration of spectral line shapes are described. NSA

N67-21600# Illinois Univ., Urbana.

SCANNING AND MEASURING PROJECTOR

R. W. Downing, D. W. Mortara, and C. A. Schaad 10 Nov. 1966 45 p
(Contract AT(11-1)-1195)
(COO-1195-81) CFSTI: HC $3.00/MF $0.65

The Scanning and Measuring Projector (SMP) is a semiautomatic device for making rapid and accurate measurements of particle interactions from photographs of these events as they occurred within a bubble chamber. The SMP and a general purpose digital computer, CSX 1, work together in an integrated system. The operator scans the film and guides a detector approximately (±0.5 cm) along the path of the points to be measured. The points are accurately digitized by an apparatus that sweeps the selected portion of the image across a fixed pattern of reference marks. The overall layout of the SMP system is described and the SMP digitizing mechanism and process are explained. Also discussed are the pattern-recognition and time-sharing aspects of the corresponding computer program and its error-correction capabilities. Author (NSA)

N67-21602# Minnesota Univ., Minneapolis. John H. Williams Lab. of Nuclear Physics.

[ACCELERATOR PROGRESS, EXPERIMENTAL PROGRAM, AND EXPERIMENTAL INSTRUMENTATION] Progress Report, Aug. 1965-Jul. 1966

R. P. Featherstone et al Jul. 1966 215 p refs
(Contract AT(11-1)-1265)
(TID-23395) CFSTI: HC $3.00/MF $0.65

The performance of the proton linear accelerator is discussed, and brief accounts are given of the experiments performed using the machine. Improvements to both the machine and the experimental instrumentation are outlined. Performance tests on a new 500-keV injector are reported. Work on the tandem Van de Graaff accelerator was concerned with the assembly and installation of the machine and with preparations for experimental work. Work is also reported on elastic and inelastic proton scattering; pickup reactions; isomeric states in nuclei; measurements of the linear accelerator spectrometer; optical model studies; the diffraction model for direct reactions; investigation of analog laws for E-dE/dx systems; properties of bound states of one-particle one-hole nuclei near Pb^{208} quasi-elastic scattering; on-line computer operation; particle detection systems electronic instrumentation; and mechanical instrumentation. NSA

N67-21648# General Electric Co., Schenectady, N. Y. Knolls Atomic Power Lab.

SINGLE PAN BALANCE WEIGHING OF CORROSION COUPONS

E. J. Callahan and A. C. Titus 30 Sep. 1966 20 p refs
(Contract W-31-109-ENG-52)
(KAPL-M-6577) CFSTI: HC $3.00/MF $0.65

A procedure has been derived to verify the Class S tolerances of the internal balance ring weights of a single-pan semimicro analytical balance, since gravimetric effects of corrosion can be observed more accurately when the analytical balance used to make gravimetric measurements is periodically calibrated. These procedures assure that anticipated small weight differences will be detected even though these values are close to the weighing accuracy of the balance. Author (NSA)

N67-21693# California Univ., Livermore. Lawrence Radiation Lab.

MICROWAVE SPECTROMETER AND ITS RESEARCH APPLICATIONS

Klaus Ernst and Roger Anderson 16 Jun. 1966 14 p
(Contract W-7405-ENG-48)
(UCID-5168) CFSTI: HC $3.00/MF $0.65

Information concerning the capabilities of a recently completed microwave spectrometer are presented. After a brief description of the instrument and its performance, the use of microwave spectroscopy in chemistry research and research in chemical kinetics is outlined. NSA

N67-21794# Production Group, United Kingdom Atomic Energy Authority, Annon (Scotland).

THE APPLICATION OF CONDENSED-STATE TECHNIQUES TO NEUTRON DOSIMETRY

D. E. Watt [1966] 22 p refs Presented at the Soc. for Radiological Protect. Symp. on Dose Meas. Tech. Under Develop., London
(PG-711) BIS: $0.80/HMSO: 4s

There are three general approaches to dose measurement in a neutron radiation field. A review of the various types of solid and liquid neutron dosimeters under development is presented. The application and range of sensitivity within the three general categories are considered and summarized in a table. A full list of references to relevant work is provided. Author (NSA)

N67-21808# Oesterreichische Studiengesellschaft fuer Atomenergie G.m.b.H., Seibersdorf.

THE PHYSICS OF HIGH RESOLUTION GAMMA-SPECTROSCOPY AND EXPERIMENTAL RESULTS WITH A SEMI-CONDUCTOR COMPTON-SPECTROMETER FOR NONDESTRUCTIVE BURN-UP DETERMINATION OF NUCLEAR FUEL

Michael Higatsberger Sep. 1966 20 p refs Presented at the Symp., on Phys. of Nondestructive Testing, Chicago, 27–30 Sep. 1966
(SGAE-G-4/1966; CONF-660938-1)

Operating principles of a semiconductor Compton spectrometer are discussed. Its performance in determining the burnup history of the reactor fuels is discussed. NSA

N67-21809# Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.
SCANNING TABLE BIP 101 FOR BUBBLE CHAMBER PICTURES [TABLE DE DEPOUILLEMENT BIP 101 POUR CLICHES DE CHAMBRES A BULLES]
Christian Calmels Sep. 1966 8 p refs
(EA-R-3045)

BIP 101 is a new scanning table for bubble chamber pictures, especially aimed at the full scale projection of the CERN 2m hydrogen chamber. The table itself is divided in two half tables, each of them receiving, successively or simultaneously, the projections of 2 of the 4 films. Projectors with film transport are located in the central space between both half tables. Their light is reflected on 2 mirrors fixed at the ceiling. Thus the 4 sides of the table are freely accessible to the scanners. It will be possible to equip later the table with digitizers, allowing premeasurements of the events for HPD device, or even measurements. Author (NSA)

N67-21810# Phylatron Corp., Columbus, Ohio.
DEVELOPMENT OF A FAST NEUTRON DOSIMETRY SYSTEM Final Report
B. H. Chase, W. H. Closser, R. R. Speers, J. M. Swartz, and M. O. Thurston 1 Oct. 1966 53 p refs
(Contract AT(11-1)-1226)
(COO-1226-12) CFSTI: HC $3.00/MF $0.65

The various aspects of a program for the development of a highly sensitive fast neutron dosimetry system are discussed. Topics included are processing studies, dosimeter irradiation behavior, Pu–Be source irradiations, room temperature annealing, badge design requirements, base width dosimeter, extended range of dosimeter, surface leakage, and reader for dosimeter. NSA

N67-21866# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
AN INSTRUMENT FOR MEASURING THE THICKNESS OF THIN NONMAGNETIC AND NONMETALLIC COVERINGS ON A FERROMAGNETIC BASE
I. V. Svistunov and N. L. Bondarenko 9 Sep. 1966 6 p Transl. into ENGLISH from Russian Patent no. 170695 (Appl. no. 863115/26-10, 26 Oct. 1963) 3 p
(FTD-HT-66-96; AD-643700) CFSTI: HC $3.00/MF $0.65

The object of the invention is an instrument for measuring the thickness of thin nonmagnetic and nonmetallic coverings on a ferromagnetic base, which contains a generator, measuring and compensating bridges, a resonance amplifier, a resonance cascade, two detectors, a summing block and a measuring instrument. To exclude the effect of a change in the magnetic permeability of the base upon the accuracy of the measurements, the measuring bridge with inductive transducers and balancing elements is connected to the inputs of a two-channel resonance amplifier whose first channel is tuned to the third harmonic of the generator frequency and the second channel is tuned to the basic frequency of the generator. Author (TAB)

15 MACHINE ELEMENTS AND PROCESSES

Includes bearings, seals, pumps, and other mechanical equipment; lubrication, friction, and wear; manufacturing processes and quality control, and reliability; drafting; and materials fabrication, handling, and inspection.

N67-20473# Automation Industries, Inc., Boulder, Colo. Research Div.
ADVANCEMENT OF ULTRASONIC TECHNIQUES USING RERADIATED SOUND ENERGIES FOR NONDESTRUCTIVE EVALUATION OF WELDMENTS Quarterly Progress Report, 1 Apr.–30 Jun. 1966
B. T. Cross and W. M. Tooley 5 Jul. 1966 21 p
(Contract NObs-92530)
(TR-66-32; QPR-4; AD-641026) CFSTI: HC $3.00/MF $0.65

Various Delta Configuration, including oscillating search units, were used to evaluate butt welds containing natural defects. A schlieren optical system was used to photograph the characteristic sound beam patterns associated with the operations of the Delta technique. The Delta Technique is a multi-search unit method of ultrasonic weld inspection. Incident energy is angled into the weld region from two transmitters positioned transverse to the weld length, one on each side of the weld. Flaw information is received with a third search unit positioned directly over the weld. Flaw information is not dependent on preferred flaw orientation, although the receiver must be directly over the defect. Author (TAB)

N67-20508# American Optical Co., Southbridge, Mass. Research Div.
PREPARATION OF PLATINUM-FREE LASER GLASS Semiannual Technical Report, 1 Jan.–31 Jul. 1966
Richard F. Woodcock, George A. Granitsas, and Carl G. Silverberg 31 Jul. 1966 18 p
(Contract Nonr-4656(00); ARPA Order 306-62; Proj. Defender)
(SATR-4; AD-643259) CFSTI: HC $3.00/MF $0.65

The purpose of this project is to produce high optical quality laser glass free of platinum particles. It was found that glass melted under an inert atmosphere in a platinum crucible contained no detectable platinum particles. Methods to prevent evaporation of various oxides that caused inhomogeneities in the glass were investigated. Data was accumulated to determine the effect of time, temperature, and atmosphere on the weight loss of platinum and alloying of platinum with ingredients in glass. A parallel approach to this problem is the melting of glass in a high purity all ceramic system. Modifications of the system, based on results of the initial runs, have been completed. Failure of a high temperature sprinkler head during testing of the furnace has seriously delayed this phase of the project. Author (TAB)

N67-20558# Curtiss-Wright Corp., Caldwell, N. J. Curtiss Div.
DIAGNOSTIC NOISE STUDY OF POWER TRANSMISSION SYSTEMS Final Report
R. G. Locklin Sep. 1966 86 p
(Contract DA-44-177-AMC-249(T))
(C-2979; USAAVLABS-TR-66-55; AD-642523) CFSTI: HC $3.00/MF $0.65

An investigation was made of noise in the X-19 power transmission system to demonstrate the feasibility of using the diagnostic sonic technique to determine the mechanical condition

of the internal gearing and bearings. The method employed in monitoring the transmission system utilizes the noise generated by gears and bearings to determine integrity of the system. The condenser type microphone system was utilized to record these signals on magnetic tape, and the recorded data were then analyzed using the panoramic sonic analyzer. In addition to the diagnostic sonic concept, a spectrometric oil analysis of the system was also made. The diagnostic sonic analysis of the X-19 power transmission system was successful in detecting the majority of the system anomalies including a gear fatigue failure, several bearing failures, and gear tooth scuffing conditions. Correlation between acoustic and spectrometric oil analysis was also achieved. The results of this investigation indicate the ability of the diagnostic sonic analysis technique in determining the mechanical integrity of the X-19 power transmission system. Although spectrometric oil analysis cannot indicate fatigue failures which may occur between sampling periods and obviously cannot check nonlubricated components, in many cases additional information is obtained by the correlation of the oil sampling and sonic methods. Author (TAB)

N67-20581# Automation Industries, Inc., Boulder, Colo. Research Div.

ADVANCEMENT OF ULTRASONIC TECHNIQUES USING RERADIATED SOUND ENERGIES FOR NONDESTRUCTIVE EVALUATION OF WELDMENTS Quarterly Progress Report, 1 Jan.–31 Mar. 1966

B. T. Cross and W. M. Tooley 1 Apr. 1966 26 p
(Contract NObs-92530)
(TR-66-19; QPR-3; AD-641025) CFSTI: HC$3.00/MF$0.65

Some of the energy radiations which were not included in mode conversion were measured and analyzed. The combined information from the previous work efforts was used in preliminary investigation of weld samples containing actual defects. The Delta was used in various configurations, each exploiting a distinct characteristic of the Delta operation. Combinations of these Delta characteristics provided Delta scan recordings showing excellent correlation with radiographs of the respective weld samples. The Delta Technique is a method of ultrasonic weld inspection using a two search unit configuration. The transmitted energy is angled into the weld region from a search unit positioned to one side of the weld. Flaw information is received with the other search unit positioned directly over the weld. In the Delta Technique, flaw information is not dependent on a preferred defect orientation; however, the receiver search unit must be directly over the defect. The work performed to date is encouraging, because all test results support the Delta concept as an ultrasonic weld inspection technique that is unrestricted by defect orientation and is capable of inspecting welds at the rate of several feet per hour. Author (TAB)

N67-20585# Virginia Univ., Charlottsville. School of Engineering and Applied Science.

ANALYSIS OF THE DYNAMICS OF SUPERCRITICAL SHAFTS ON MANY FLEXIBLE SUPPORTS BY USING TRANSMISSION LINE ANALOGY

Y. N. Liu and J. A. Friedericy Sep. 1966 172 p refs
(Grant DA-AMC-44-177-63-G10)
(USAAVLABS-TR-66-44; AD-642592) CFSTI: HC $3.00/MF $0.65

The report presents an analysis of the dynamics of supercritical shafts on many flexible supports in terms of a so-called transmission line analogy. The primary objective of the study is to develop a direct analytical approach for optimizing the support conditions, in terms of minimum flexural vibration behavior, for supercritical shafts flexibly supported on mass-spring-damper units at different locations along the shaft. The approach is based on the traveling wave concept as used in electrical transmission line theory. The governing differential equation used in this analogy includes terms which account for the effects of rotating inertia, gyroscopic motion, and shear deformations. Author (TAB)

N67-20641# Litton Systems, Inc., Minneapolis, Minn. Applied Science Div.

SPUTTERING Annual Report, 1 Nov. 1965–31 Oct. 1966

G. S. Anderson, G. V. Jorgenson, and G. K. Wehner 8 Dec. 1966 53 p refs
(Contract Nonr-1589(15))
(Rept.-3047; AD-643920) CFSTI: HC$3.00/MF$0.65

Relative sputtering yields were determined for variously oriented GE surfaces above and below the annealing temperature. The yield for GE (100) was found to be higher for an ordered surface than for a damaged surface. The opposite is true in the case of GE (110) and no change was observed for GE (111). Alloy targets were sputtered to determine the amount of sputtering required to reach equilibrium conditions, where material is removed in the same proportions as the bulk. This produces a target surface layer of altered composition. In alloys of 55% Cu and 45% Ni, and of 90% Ni and 10% Ti, it appears that an equivalent of 10–20 atomic layers must be removed before equilibrium conditions are reached at bombarding ion energies of 500–1000 eV. Simultaneous sputtering of two targets with widely different yields produces some puzzling results. Only a small number of atoms from the low yield target, when deposited on the high yield target, produce a surface covered with cones and this results in a sizeable reduction in sputtering yield. A quadrupole mass filter system for analysis of sputtered material has been assembled and tested. Author (TAB)

N67-20643# Device Development Corp., Waltham, Mass.

RESEARCH ON OPTICAL CONTACT BONDING Final Report, 15 May 1963–28 Feb. 1966

R. B. Holt, H. I. Smith, and M. S. Gussenhoven 30 May 1966 43 p refs
(Contract AF 19(628)-3237)
(AFCRL-66-649; AD-643285) CFSTI: HC $3.00/MF $0.65

The adhesion of optically polished surfaces–'optical contact'–was investigated both under room conditions and ultrahigh vacuum with the twofold objective of determining the adhesion mechanism and its characteristics and extending the technological applications. It is shown that optical contact adhesion occurs readily under ultrahigh vacuum, thus demonstrating that the widely held liquid layer theory is not complete. Adhesion mechanisms are discussed, and it is concluded that London dispersion forces are responsible for the adhesion under ultrahigh vacuum. For optical contacts made under room conditions, surface tension of a liquid probably also contributes. It is shown that optical contact techniques can be used to obtain extremely efficient transducer-sample bonds for gigacycle ultrasonic work. Reflections as low as 1% of the incident acoustic power were obtained at 3 gc and 9 gc. Techniques for making such bonds are discussed. It is pointed out that the incorporation of evaporated metal films should enhance the properties of optical contact bonds and eliminate some practical difficulties. The design and development of a high vacuum evaporator are described. Author (TAB)

N67-20741# Kernforschungsanlage, Juelich (West Germany). Zentralabteilung Strahlenschutz.

MEASUREMENT OF THE ADSORPTION CHARACTERISTICS OF VARIOUS FILTERS FOR GASEOUS IODINE [MESSUNG DER ADSORPTION-SEIGEN-SCHAFTEN VERSCHIEDENER FILTER FUER GASFOERMIGES JOD]

K. J. Vogt and J. Meringdal Mar. 1966 44 p refs In GERMAN
(JUL-363-ST)

Various active C filters (active C granulated cartridges, active C paper filters, and aerosol filters coated with active C powder) were investigated with respect to their adsorption for gaseous iodine I_2 An exponential dependence of the permeability on the active C surface coating of the filter was found. The mass adsorption coefficient is an exponential function of the flow velocity. The

adsorption capacity and decrease of the filter efficiency with increasing preliminary charge of the active C with I for foreign gases were measured. For practical application as a filter in air monitoring installations the filter media tested were found to be suitable. Active C in suitable design of the filter installation can be used as purification filters. The results of the investigations permit the optimum regulation of the active C coating and the diameter of the filter, the flow velocity, or the volume throughput, and the filter life. In very impure air the use of granulated cartridges with sufficiently high active C masses is recommended in order to obtain a high adsorption capacity. Aerosols can be separated by a preliminary filter. Under normal contamination ratios of the air, such as in free atmosphere, continuous monitoring with filter band devices offers technical advantages. The normal filter installation can be made applicable for I measurements in which the absolute filter used for normal aerosols was covered with active C powder. The active C paper filters No. 508 and 509 are not manufactured in the length suitable for filter bands. They are suitable only for fixed filter installations. Author (NSA)

N67-20825# Union Carbide Nuclear Corp., Oak Ridge, Tenn. Y-12 Plant.

MACHINING AND MEASUREMENT TO SUBMICRON TOLERANCES

L. G. Whitten and T. G. Lewis (Du Pont, Wilmington, Del.). 8 Sep. 1966 41 p Presented at the 7th Intern. Machine Tool Design and Res. Conf., Birmingham, England, 12–16 Mar. 1966 revised

(Contract W-7405-ENG-26)

(Y-KE-204, Rev.; CONF-660922-1) CFSTI: HC $3.00/MF $0.65

The design of a machine capable of turning an Al alloy hemisphere 4 in. in diameter and deviating at no point more than 25 μ inches from that diameter is described. Typical machining and measurement procedures used in operating the machine are outlined. The machine is to be used as an instrument for studying individual machining variables. Details of air bearing design considerations, interferometer measuring systems, and temperature sensors are given in appendixes. NSA

N67-20830# Oak Ridge National Lab., Tenn.

MANIPULATOR MAINTENANCE PROGRAM AT OAK RIDGE NATIONAL LABORATORY

D. T. Dice, R. G. Jenness, and C. D. Wicker [1966] 13 p refs Presented at 14th Conf. on Remote Systems Technol., Pittsburgh

(Contract W-7405-ENG-26)

(ORNL-P-2356; CONF-661001-20) CFSTI: HC $3.00/MF $0.65

The volume of master–slave manipulator maintenance at Oak Ridge National Laboratory has necessitated the establishment of a repair facility and organization of a specially trained group of craftsman. Emphasis on cell containment requires the use of manipulator boots and development of precise procedures for accomplishing the maintenance of 237 installed units. To provide the most economical type of preventive maintenance a very satisfactory computer programmed maintenance system was established. Author (NSA)

N67-20878# Roentgen Technische Dienst N. V., Rotterdam (Netherlands).

ULTRASONIC EXAMINATION OF WELDED JOINTS IN STEEL PLATE OF THICKNESSES UP TO 300 MM

A. de Sterke [1966] 31 p ref Presented at the Intern. Inst. of Welding 19th Ann. Assembly, Delft, Netherlands Sponsored by the Joint United States-EURATOM Res. and Develop. Program

(V-318-66/OE; EUR-2883; EURAEC-1695; CONF-660718-1) CFSTI: HC $3.00/MF $0.65

Experiments were made on welds in steel having thicknesses of 100, 200, and 300 mm, using an ultrasonic pulse-echo system. The various factors which influence the flaw detectability were investigated, including surface condition, the condition of the parent metal, the position and orientation of defects and their size. It is shown that surface roughness not only affects acoustic coupling but also causes beam distortion. Laminar flaws, which are more readily found in thick plates, obscure the image of the internal weld condition when they occur in the vicinity of the weld. The position, orientation, and size and width of defects have a combined effect on detectability. Although in one case very small defects can be found in welds even up to 300 mm thick, in other cases the detection of gross defects in thinner sections may call for special techniques. The problem of the sensitivity setting is discussed against the background of the above parameters. For adequate correlation of data found during scanning, the information recording should be coupled to mechanized scanning systems. The evaluation of the ultrasonic results points to the need for special recording systems, able to plot indications of defects in terms of position and length, as well as their location in cross sectional view. Several approaches to this problem are indicated, such as pen-records, dynamic screen images, B-scope presentation, and the use of a facsimile recorder. Author (NSA)

N67-20902# National Lead Co. of Ohio, Cincinnati.

ELECTRONICALLY CONTROLLED UNIVERSAL TESTING MACHINE FOR ELEVATED TEMPERATURE TESTING OF URANIUM

L. G. Wexlin 4 Oct. 1966 18 p Presented at the 16th Ann. Natl. Lead Co., Anal. and Phys. Testing Symp., West Caldwell, N. J., 13–14 Oct. 1966

(Contract AT(30-1)-1156)

(NLCO-984; CONF-661022-1) CFSTI: HC $3.00/MF $0.65

An electronically controlled universal testing machine is described having a load frame of 120,000 pound capacity and a hydraulic system with a double-acting piston that can be driven at rates as high as 20 in./min. Control by electronic feedback permits tension or compression testing using stress, strain, or table position as the controlled variable. It is also possible to perform cyclic tests of various types such as tension–tension, tension–compression, and similar combinations using a signal generator, magnetic tape, or other source of electronic wave forms to control the machine. All electronic equipment is consolidated in a console which includes a strip chart recorder and an X-Y plotter. Author (NSA)

N67-20928# Atomic Energy of Canada, Ltd., Chalk River (Ontario).

FORMING UNIFORM THICK OXIDE LAYERS ON ZIRCALOY-2 FOR FRICTION AND WEAR APPLICATIONS IN HIGH TEMPERATURE WATER

R. D. Watson Mar. 1966 33 p refs

(AECL-2542) Available from Atomic Energy of Canada, Ltd., Chalk River: $1.00

Several methods of producing uniform buff oxide layers in Zircaloy-2 were developed. The oxidized material has excellent wear resistance and should be useful for parts in rubbing contact in water-lubricated mechanisms operating at 500°F. The oxidation rate of Zircaloy-2 in air is dependent on the surface texture and the treatment given it. A rough surface produced by machining or grit blasting assures formation of uniform buff post-transition oxide layers. Fine surfaces produced by grit blasting, polishing, machining or grinding decrease the oxidation rate and prevent formation of uniform buff post-transition oxides. Deep scratches increase the oxidation rate apparently because of the surface roughness produced. The oxidation resistance of machined, ground, or polished Zircaloy-2 is not improved by pickling. Author (NSA)

N67-20944# Stanford Research Inst., Menlo Park, Calif.

EXPLOSIVE FORMING OF WROUGHT INGOT BERYLLIUM Final Report

A. E. Bayce and N. H. G. Daniels Jun. 1966 24 p Prepared for Sandia Corp., Albuquerque, N. Mex.
(Contract AT(29-1)-789)
(SC-RR-66-2070) CFSTI: HC $3.00/MF $0.65

Six experiments were performed to obtain preliminary information on the explosive forming of Be 0.15- and 0.50-in. thick wrought ingot plates. Tests generally resulted in cracking, but also showed evidence of bending corresponding to surface strains of the order of 1/2%. One test, resulting in a larger radium bend, did not cause any cracking of the sample plate. It is considered that improvements in the material condition and in the explosive forming techniques used could lead to a much greater degree of success in forming Be by explosive techniques. Author (NSA)

N67-20950# Union Carbide Corp., Oak Ridge, Tenn. Gaseous Diffusion Plant.

PROCEDURE FOR ELECTROLESS PLATING OF NICKEL AND FIBERGLASS

G. S. Petit and C. C. Wright 5 Oct. 1966 10 p refs
(Contract W-7405-ENG-26)
(K-L-2338) CFSTI: HC $3.00/MF $0.65

A procedure is given for the plating of an adherent, smooth, and uniform film of nickel on fiberglass cemented with an epoxy resin. The procedure involves the application of a flash palladium coating prior to plating. A 0.002-in. plating requires a force of 1100 lb/in.^{2} to strip it off the fiberglass from a 1-in.^{2} interface. NSA

N67-20981* North American Aviation, Inc., Downey, Calif. Space and Information Systems Div.

RELIABILITY ASSESSMENT GUIDES FOR APOLLO SUPPLIERS

B. L. Amstadter and T. A. Siciliano Sep. 1965 103 p refs Revised Supersedes SID-64-1447
(Contract NAS9-150)
(NASA-CR-83055; SID-64-1447A; SID-64-1447) CFSTI: $3.00 CSCL 14D

The requirements, criteria, and methods to implement appropriate paragraphs in referenced specifications are defined for those suppliers not required to have formal reliability program planes. In addition to general requirements and criteria for determing the type of assessment, techniques are provided for assessing the reliability of system and components using data from actual tests and inspections subsequent to firm design release. Reliability–confidence relationships are established so that reliability can be assessed at any desired confidence level, or, given the reliability, the corresponding confidence level can be determined for the applicable sample size. Criteria for the selection of applicable methods are given, required data are indicated, appropriate equations are defined, and tables and graphs are provided. Author

N67-20990# Isochem, Inc., Richland, Wash. Chemical Processing Div.

SEALING OF PLASTIC FILM BY ELECTRONIC WELDING FOR ALPHA CONTAMINATION CONTROL

J. W. Fillmore and H. A. Moulthrop 22 Jun. 1966 27 p Presented at the Am. Nucl. Soc. 14th Conf. on Remote Systems Technol., Pittsburgh, 1–3 Nov. 1966
(Contract AT(45-1)-1851)
(ISO-SA-23; CONF-661001-11) CFSTI: HC $3.00/MF $0.65

A simple but significant method utilized as an aid for control of alpha contamination in a plutonium manufacturing facility is the technique of electronically sealing plastic bags containing alpha radioactive contaminated articles or radioactive material. A radio frequency (RF) field and a press or sealing bar are used to seal plastic bags. The sealing bar conducts the RF field and creases the plastic to form a welded seam as the plastic film is heat softened and flows together. The equipment is portable and requires a minimum of personnel training for effective use. Author (NSA)

N67-20993# Atomics International, Canoga Park, Calif.

SCTI-BOLTED FLANGE CONNECTIONS IN HIGH TEMPERATURE-HIGH PRESSURE STEAM SERVICE

C. V. Di Pol 10 Jun. 1966 35 p refs
(Contract AT(11-1)-GEN-8)
(NAA-SR-MEMO-11992) CFSTI: HC $3.00/MF $0.65

Bolted flange connections in high temperature–high pressure service at the Sodium Components Test Installation (SCTI) are described. Review of various government and national society regulations and codes determined that the ASA "Code for Pressure Piping", ASA B31.1, is the applicable design code. The system was initially designed in accordance with this code. Current industry particles relative to bolted connections in extreme steam service were reviewed. The original design and installation conformed with code requirements and/or current industry practice, except in the areas of gasket material; bolt material; bolt preload; and in the use of bolted joints. Code requirements relative to gasket and bolting material are poorly defined, and current industry practice is to avoid bolted connections in extreme steam service insofar as possible. Thermal stress considerations in piping and in uninsulated flanges were evaluated, and the stress levels encountered in the system should not be a significant cause of leakage in properly bolted joints. The basic cause of the experienced steam leaks appeared to be in adequate bolting. Engineering recommendation to assure sustained leak free operation is to eliminate bolted flange connections and go to an all welded system. Alternate modification to the existing bolted connections were developed for evaluation and decision. These alternate modifications will significantly reduce the leakage potential but will not remove the possibility of future leaks at the joints. Author (NSA)

N67-21014# Atomic Energy of Canada, Ltd., Chalk River (Ontario).

WEAR AND CORROSION IN WATER

R. D. Watson 19 Feb. 1966 85 p refs Revised
(AECL-2566; EDI-67, Rev.) Available from Atomic Energy of Canada, Ltd., Chalk River: $2.00

The wear resistance of a number of different combinations of materials was investigated in water at room temperature. For journal bearing applications, it was found that the different combinations could be divided into two groups: those that wear at a constant rate; and those that wear at a continually decreasing rate. The first group covers those combinations that cannot provide a suitable surface finish on the rubbing surfaces through wear to allow the formation of a thin supporting film of fluid. The second group combinations produce fine abrasive wear and provide polished surfaces that can sustain thin films which will support all or part of the load. The wear resistance of thin stable metallic oxides was investigated. The crevice corrosion resistance of a number of compatible combinations was studied in different aqueous environments. Author (NSA)

N67-21060 Westland Aircraft, Ltd., Yeovil (England). Saunders Roe Div.

FRETTING FATIGUE OF JOINTS. PART 5: STEEL LUGS

A. W. Andrews, E. Heber and F. A. Kerry London, Min. of Aviation, Apr. 1966 9 p
(Contract KS/1/0202/CB.43(a)2)
(S&T-MEMO-12/65)

The fretting fatigue characteristics of pin joints in DTD 473 high tensile steel and the effect of several jointing compounds or special treatments to either the pin or the hole in the lug were investigated. The compounds chosen were those that had given

the best results in the work on aluminium alloy lugs Duralac 4678 and 8817, British Timken Frin, and Duckhams Keenomax C3. None of the compounds showed any marked advantage over a sample of one of the standard jointing compounds commonly used.
Author

N67-21164*# Chrysler Corp., New Orleans, La. Space Div.
DUO-CHECK VALVE, 2-INCH MISSION VALVE AND PUMP COMPANY PART NUMBER 15BVFCC1C, NASA DRAWING NUMBER 75M04406 PCV-2 Test Report
Donald R. Hardwick 15 Sep. 1966 47 p
(Contract NAS8-4016)
(NASA-CR-83117; TR-RE-CCSD-FO-1071-3) CFSTI: HC $3.00/MF $0.65 CSCL 13K

The specimen performance was in accordance with the specification requirements of NASA throughout the test program. It was noted during functional testing that some seat leakage occurred below 15 psig. Seat leakage at 10 psig was one drop per minute. However, since the valve was designed for use above 50 psig, the low pressure seat leakage is not considered detrimental.
Author

N67-21221# Israel Program for Scientific Translations, Ltd., Jerusalem.
THE USES OF RADIOACTIVE ISOTOPES AND NUCLEAR RADIATION IN THE U.S.S.R. VOLUME III: MACHINE BUILDING, METALLURGY
S. V. Rumyantsev, V. A. Tsepaev, P. L. Gruzine, A. K. Lebadev, and G. S. Gerasimchuk, ed. 1966 229 p refs Transl. into ENGLISH of the book "Radioaktivnye Izotopy i Yadernye Izlucheniya v Narodnom Khozyaistve SSSR" Moscow, Gos. Nauchn.-Tekhn. Izd., 1961 Proc. of the All-Union Conf. held at Riga, 12–16 Apr. 1960 Published for AEC and NSF
(AEC-TR-6466/3) CFSTI: HC $3.00/MF $0.65

Conference papers are presented on industrial applications of radioactive isotopes and nuclear radiations in the U.S.S.R. For individual titles see N67-21222–N67-21276.

N67-21222# Israel Program for Scientific Translations, Ltd., Jerusalem.
CURRENT STATE AND PROSPECTS OF THE APPLICATION OF RADIOISOTOPES AND NUCLEAR RADIATION IN MACHINE BUILDING
S. V. Rumyantsev *In its* The Uses of Radioact. Isotopes and Nucl. Radiation in the U.S.S.R. Vol. III: Machine Bldg., Met. 1966 p 1–7 (See N67-21221 10-15) CFSTI: HC $3.00/MF $0.65

Use of radioisotopes in the quality control of technological processes and inspection of manufactured products is reviewed; and specific applications for theoretical and practical researches in metallurgy, foundry operations, and welding are mentioned. An overview is included of radioisotope and nuclear radiation applications to wear studies aimed at increasing the service life of machine components and cutting tools used in industry; and savings to the national economy are cited for gamma flaw detection programs used in several industrial processes.
M.W.R.

N67-21223# Israel Program for Scientific Translations, Ltd., Jerusalem.
EXPERIENCE GAINED IN THE USE OF RADIOISOTOPES AT THE MOSCOW AUTOMOBILE PLANT IM. I. A. LIKHACHEV
B. I. Anisimov *In its* The Uses of Radioact. Isotopes and Nucl. Radiation in the U.S.S.R. Vol. III: Machine Bldg., Met. 1966 p 8–10 (See N67-21221 10-15) CFSTI: HC $3.00/MF $0.65

Rsdioisotopes are used in the manufacturing processes at an automobile plant for: (1) checking, signalling, or controlling automated operations; (2) flaw detection and quality control of castings; and (3) establishing optimum conditions for processes. Mention is made of a unit for blocking subassemblies in automatic transfer machines for cold stamping of a sheet metal. A filmless flaw detector is under development; and studies are being made of cutting-tool wear and machine component wear, for which the isotope method is considered better than micrometric methods.
M.W.R.

N67-21224# Israel Program for Scientific Translations, Ltd., Jerusalem.
RADIOACTIVE METHOD OF PROCESS CONTROL IN AUTOMATIC STAMPING
V. T. Meshcherin, A. E. Artes, and V. A. Yanushkovskii *In its* The Uses of Radioact. Isotopes and Nucl. Radiation in the U.S.S.R. Vol. III: Machine Bldg., Met. 1966 p 11–16 (See N67-21221 10-15) CFSTI: HC $3.00/MF $0.65

Advanced means of mechanization and automation resulted from the introduction of a radioactive method of process control in sheet stamping. Further, radioactive blocking of multiposition automatic presses for the processing of blanks has made it possible for one operator to service several presses and to control thickness of the stamped blanks. Control of position and orientation of blanks during automatic stamping and processing, as well as counting the number of parts produced is also accomplished by isotope methods. Automatic measurement of distances between the working planes of a hydraulic forging press is also discussed.
M.W.R.

N67-21225# Israel Program for Scientific Translations, Ltd., Jerusalem.
EXPERIENCE GAINED IN THE INTRODUCTION OF RADIOACTIVE ISOTOPES AT THE YAROSLAVL ENGINE PLANT
N. M. Genkin, F. M. Lipkin, and B. I. Elizarov *In its* The Uses of Radioact. Isotopes and Nucl. Radiation in the U.S.S.R. Vol. III: Machine Bldg., Met. 1966 p 17–19 (See N67-21221 10-15) CFSTI: HC $3.00/MF $0.65

A radioactive meter for determining thickness of cylinder walls of diesel blocks and a reflection gauge for determining thickness of the tin coating on the steel–aluminum bushing for conditions, the radiation source is of very low activity.
M.W.R.

N67-21226# Israel Program for Scientific Translations, Ltd., Jerusalem.
SAVINGS RESULTING FROM THE USE OF RADIOISOTOPES IN MACHINE BUILDING
K. A. Gracheva, V. A. Letenko, V. I. Postnikov, S. G. Purtov, and I. M. Razumov *In its* The Uses of Radioact. Isotopes and Nucl. Radiation in the U.S.S.R. Vol. III: Machine Bldg., Met. 1966 p 20–23 *ref* (See N67-21221 10-15) CFSTI: HC $3.00/MF $0.65

Instruments with radioisotopes can be used instead of contact equipment to measure the thickness of rolled metals. Higher productivity of rolling mills results because of increase in rolling rate, reduction in monitoring time, lowering reject percentages, and closer tolerances. Examples are given of actual monetary savings that can be achieved in industrial situations. In the case of tin coatings, both a savings in testing costs and tin usage are effected by the use of radioisotopic testing instead of chemical methods.
M.W.R.

N67-21227# Israel Program for Scientific Translations, Ltd., Jerusalem.
GAMMA FLAW DETECTION IN THE SHIPBUILDING INDUSTRY

O. N. Zhukov, I. F. Kuznetsov, E. N. Neelov, and V. P. Strogin *In its* The Uses of Radioact. Isotopes and Nucl. Radiation in the U.S.S.R. Vol. III: Machine Bldg., Met. 1966 p 24–28 (See N67-21221 10-15) CFSTI: HC$3.00/MF$0.65

Since the volume of radiographic work at shipyards is great, the introduction of gamma flaw detection methods has resulted in considerable savings in time, equipment, and personnel requirements. Along with savings, improvements in inspection procedures are achieved. Widely used gamma sources in shipbuilding and related industries include iridium 192, cesium 137, thulium 170, and selenium 75. Work is underway on the use of barium 133, as well as improving control methods for the inspection of metal thickness. As a result, substantial increase in control sensitivity has been achieved for welded seams of 100 to 150 mm in thickness. Mention is made of other attempts to improve inspection procedures with the used of gamma flaw detection methods. M.W.R.

N67-21228# Israel Program for Scientific Translations, Ltd., Jerusalem.

RESULTS OF THE INTRODUCTION OF GAMMA FLAW DETECTION WITH THULIUM-170

A. P. Ivanov *In its* The Uses of Radioact. Isotopes and Nucl. Radiation in the U.S.S.R. Vol. III: Machine Bldg., Met. 1966 p 29–32 ref (See N67-21221 10-15) CFSTI: HC $3.00/MF $0.65

Use of thulium 170 as the gamma source for flaw detection in thin-walled welded and cast articles of steel and light alloys is discussed. An experimental gamma ray unit, GUP-Tu-0.5-1, was found to be feasible for inspecting (1) portions of components with a directed beam and (2) annular seams in large-size weldments. When the source was taken out of its container, simultaneous inspection of several longitudinal seams could be made. Various inspection methods are compared, and thulium sources of activity of 0.5 g-equiv Ra can be widely used in gamma control where productivity is not the decisive factor. Lower activity sources are necessary when protection and transportation must be considered. M.W.R.

N67-21229# Israel Program for Scientific Translations, Ltd., Jerusalem.

GAMMA FLAW DETECTION AT THE PLANT OF MATERIALS HANDLING EQUIPMENT IM. S. M. KIROV

B. S. Voitinskii *In its* The Uses of Radioact. Isotopes and Nucl. Radiation in the U.S.S.R. Vol. III: Machine Bldg., Met. 1966 p 33–34 (See N67-21221 10-15) CFSTI: HC$3.00/MF$0.65

Gamma flaw detection methods have improved quality control at an industrial plant that manufactures powerful hoisting mechanisms, such as gantry cranes and vertical lifts. The introduction in 1959 of gamma flaw detection with cobalt 60 cut the rejection of steel structures due to welding flaws from two-thirds to 7%. Use of cesium 137 and iridium 192 is considered because these isotopes will reduce the weight of the portable inspection container from 24 to 12 kg, as well as increase sensitivity to internal flaws. M.W.R.

N67-21230# Israel Program for Scientific Translations, Ltd., Jerusalem.

USE OF POWERFUL UNITS WITH RADIOISOTOPES FOR INSPECTING THE QUALITY OF WELDED JOINTS OF LARGE THICKNESS

V. I. Strakopytov *In its* The Uses of Radioact. Isotopes and Nucl. Radiation in the U.S.S.R. Vol. III: Machine Bldg., Met. 1966 p 35–37 (See N67-21221 10-15) CFSTI: HC$3.00/MF$0.65

Gammagraphy and ultrasonic flaw detection are considered good quality control procedures for inspecting welded seams in thick-walled vessels for large boilers for power plants, pressure containers, and hydraulic presses. The procedure and equipment used for gamma flaw detection are discussed, and dosimetric investigations showed practical absence of radiation in the areas where the equipment was used. It is noted that all operators working with radioactive sources are equipped with individual dosimeters. Principal drawback for gammagraphy inspection of thick-walled welded vessels lies in its low sensitivity. M.W.R.

N67-21231# Israel Program for Scientific Translations, Ltd., Jerusalem.

EXPERIENCE GAINED IN THE APPLICATION OF RADIOISOTOPES FOR PURPOSES OF FLAW DETECTION AT THE "RUSSKII DIZEL'" PLANT

M. Ya. Budovskii *In its* The Uses of Radioact. Isotopes and Nucl. Radiation in the U.S.S.R. Vol. III: Machine Bldg., Met. 1966 p 38–41 (See N67-21221 10-15) CFSTI: HC$3.00/MF$0.65

Gamma flaw detection procedures are shown to cost less than half that of X-ray flaw detection, principally because the radioactive method results in reduction of losses due to rejection. A cobalt 60 radioactive source, its container, and means of transportation are described; and losses for various components subjected to inspection are tabulated. M.W.R.

N67-21232# Israel Program for Scientific Translations, Ltd., Jerusalem.

METHODS AND EQUIPMENT FOR THE GAMMA FLAW DETECTION IN WELDED BUTT JOINTS OF TRUNK PIPELINES FOR GAS AND PETROLEUM

I. E. Neifel'd *In its* The Uses of Radioact. Isotopes and Nucl. Radiation in the U.S.S.R. Vol. III: Machine Bldg., Met. 1966 p 42–46 (See N67-21221 10-15) CFSTI: HC$3.00/MF$0.65

Advantages and disadvantages are given for the use of gamma flaw procedures for inspecting welded joints in gas and petroleum trunk pipelines. Advantages include low cost over mechanical inspection methods, portability of the equipment used, and accuracy of flaw detection. Disadvantages cited for an open-type capsule with cobalt 60 are the relatively low efficiency because of limiting the capsule activity, low sensitivity of the photograph, and danger to the individual operator from radioactivity exposure. Use of cesium 137 reduced much of these difficulties. Development of a container for storing and transporting the open-type capsule is discussed, and it is noted that the resulting container can also be used to inspect double-walled pipe joints. M.W.R.

N67-21233# Israel Program for Scientific Translations, Ltd., Jerusalem.

EXPERIENCE IN THE APPLICATION OF GAMMA RADIATION FROM RADIOISOTOPES Co^{60} AND Cs^{137} TO THE INSPECTION OF WELDED SEAMS AND CASTINGS AT THE NORIL'SK MINING AND METALLURGICAL WORKS IM. A. P. ZAVENYAGIN

Yu. N. Kalenikhin *In its* The Uses of Radioact. Isotopes and Nucl. Radiation in the U.S.S.R. Vol. III: Machine Bldg., Met. 1966 p 47–51 (See N67-21221 10-15) CFSTI: HC$3.00/MF$0.65

Use of cobalt 60 and cesium 137 as gamma sources for flaw detection and inspection is discussed in terms of vital castings and welded seams of boilers and pressure vessels. Equations are given for use in determining the depth of flaws as seen on the gammagraphs of small thicknesses of metal. Mention is made of experiences in industrial situations. M.W.R.

N67-21234# Israel Program for Scientific Translations, Ltd., Jerusalem.

SELECTION OF THE ECONOMICALLY MOST SUITABLE GAMMA EMITTERS FOR FLAW DETECTION

V. I. Postnikov *In its* The Uses of Radioact. Isotopes and Nucl. Radiation in the U.S.S.R. Vol. III: Machine Bldg., Met. 1966 p 52–56 (See N67-21221 10-15) CFSTI: HC $3.00/MF $0.65

Economic aspects of selecting gamma sources for flaw detection and inspection are discussed, and a method for determining optimum application of emitters is mentioned. Nomographs depict the cost of flaw detection with cobalt 60 and an iridium isotope. Comparative costs of various gamma sources, and the effect of manufacturing conditions on the cost of gamma flaw detection procedures are also shown. Savings effected by using gamma emitters for flaw detection are stressed. M.W.R.

N67-21236# Israel Program for Scientific Translations, Ltd., Jerusalem.

METHOD FOR STUDYING THE WEAR OF TRACTOR COMPONENTS WITH RADIOISOTOPES UNDER WORKING CONDITIONS, AND EXPERIENCE GAINED IN ITS INTRODUCTION

I. N. Velichkin, A. I. Nisnevich, and V. S. Tunitsyn *In its* The Uses of Radioact. Isotopes and Nucl. Radiation in the U.S.S.R. Vol. III: Machine Bldg., Met. 1966 p 60–64 (See N67-21221 10-15) CFSTI: HC $3.00/MF $0.65

Wear of engine and other tractor components under operating conditions is studied with cobalt 60 as a tracer. Wear of upper compression rings mounted on a tractor engine is graphed; and differences are noted for various temperature and atmospheric conditions. Results are also shown for wear of piston rings under different working conditions. Use of the outlined technique has prevented an excessive wear of rings under winter conditions, and has increased by about 50% the wear-resistance of components in the cylinder–piston assembly during the service life of the engine on which these studies were made. M.W.R.

N67-21237# Israel Program for Scientific Translations, Ltd., Jerusalem.

APPLICATION OF RADIOISOTOPES TO TESTING OF AUTOMOBILES AND THEIR SUBASSEMBLIES

D. I. Vysotskii and V. I. Golov *In its* The Uses of Radioact. Isotopes and Nucl. Radiation in the U.S.S.R. Vol. III: Machine Bldg., Met. 1966 p 65–68 (See N67-21221 10-15) CFSTI: HC $3.00/MF $0.65

Experiences since 1950 are reviewed for the use of radioisotopes in the inspection of automobiles and their subassemblies. Radioisotopes permitted a clear observation of the effect of gasoline quality on engine wear so that appropriate changes and standards could be made, and low toxicity antiknock gasoline additive based on iron rather than tetraethyl lead was developed. Radioisotopes were used in the selection of wear-resistant cast irons for diesel engine cylinders operating on sulfur-containing fuel, and the structure of spheroidal graphite in cerium-based cast iron was studied autoradiographically. An air filter was developed based on study of the relative wear of engine piston rings that were activated by zinc 65. A mobile laboratory was refined for use in testing engines under road conditions in order to evaluate the protection afforded by the air filter. M.W.R.

N67-21238# Israel Program for Scientific Translations, Ltd., Jerusalem

STUDIES OF THE EFFECT OF THE COMBUSTION PROCESS ON THE WEAR OF COMPRESSION RINGS IN THE DIESEL ENGINE

B. P. Pakhomov *In its* The Uses of Radioact. Isotopes and Nucl. Radiation in the U.S.S.R. Vol. III: Machine Bldg., Met. 1966 p 69–72 (See N67-21221 10-15) CFSTI: HC $3.00/MF $0.65

Effect of various operating conditions on the vertical wear of the upper compression ring of a diesel engine was studied by radioisotope detection procedures. Load and rotational speed of the crankshaft were taken into account, and a preliminary investigation was made of the centrifuge efficiency and of the deposition of mechanical impurities on the walls of the cylinder and the oil manifold. At higher gas pressure values, an increase in load was found to increase wear; and an increase in the temperatures of the exhaust gases caused a considerable increase in the vertical wear of the rings. Steps were, therefore, taken to remove heat from the zone of the upper compression ring. Results of this study were applied to production of high speed engines at a tractor plant. It is noted that the sensitivity of the procedures were low and that some of the instruments were not capable of determining slight changes in wear. M.W.R.

N67-21239# Israel Program for Scientific Translations, Ltd., Jerusalem.

RADIOISOTOPES IN MACHINING RESEARCH

E. P. Nadeinskaya *In its* The Uses of Radioact. Isotopes and Nucl. Radiation in the U.S.S.R. Vol. III: Machine Bldg., Met. 1966 p 73–81 (See N67-21221 10-15) CFSTI: HC $3.00/MF $0.65

Radioisotopes are found to be a reliable and economical means for studying the effect of the hardness and wear of high speed tool steel used in the machining of metal leads. Slight variations in steel hardness can be determined, and graphs are included to show the wear of cutting tools; effect of cutting speed, feed, quenching and tempering temperatures on wear; and effect of these temperatures on metal hardness. Optimum temperatures are included, and formulas are given for the rate of tool wear and for wear resistance of the cutting tool. M.W.R.

N67-21240# Israel Program for Scientific Translations, Ltd., Jerusalem.

BETA THICKNESS GAGE FOR BTP-1 TYPE COATINGS AND THE EXPERIENCE GAINED IN ITS INTRODUCTION AT ENTERPRISES OF THE PRINTING INDUSTRY

Yu. M. Ovchinnikov, S. V. Dolgorukov, and R. B. Koldopskii *In its* The Uses of Radioact. Isotopes and Nucl. Radiation in the U.S.S.R. Vol. III: Machine Bldg., Met. 1966 p 82–85 (See N67-21221 10-15) CFSTI: HC $3.00/MF $0.65

Basic laws of beta radiation backscattering were used to develop a semi-empirical theory for the selection of radiation source and the operation of a beta thickness gauge for measuring coating. A wiring diagram gives details of the instrument that was developed to permit determination of the thicknesses of a variety of electrolytic coatings; and it is noted that experimental instrument, which was later manufactured on a large-scale, is applicable to the determination of thickness of paints and varnishes. M.W.R.

N67-21241# Israel Program for Scientific Translations, Ltd., Jerusalem.

SELECTION OF OPTIMUM CONDITIONS FOR THE HEAT TREATMENT OF CASEHARDENING STEEL OF THE 18KHNVA TYPE

G. N. Bakakin, K. S. Gerasimenko, V. I. Doshchechkin, I. M. Lyubarskii, and A. P. Lyubchenko *In its* The Uses of Radioact. Isotopes and Nucl. Radiation in the U.S.S.R. Vol. III: Machine Bldg., Met. 1966 p 86–88 (See N67-21221 10-15) CFSTI: HC $3.00/MF $0.65

Structural and physicomechanical properties were investigated for several grades of case-hardened steel in order to select optimum heat treatment conditions and to improve wear resistance capabilities. Metallographic investigations were made to determine phase composition and structure, and the distribution of alloying elements among their phases and within a single phase was

determined autoradiographically by carbon 14 and carbon 51. The samples were activated for wear tests by introducing cobalt 60 into the molten steel or by neutron irradiation of the prepared specimens. Cooling rate after case-hardening affected the phase composition, phase substructures, and their saturation with alloying elements; and change in the wear resistance of the case-hardened layer occurred. Reducing the cycle and simplifying the heat treatment of the case-hardened layer markedly improved the wear resistance of the layer. Results are included for industrial and experimental studies. M.W.R.

N67-21242# Israel Program for Scientific Translations, Ltd., Jerusalem.

RADIOISOTOPES IN THE STUDY OF TUBE MANUFACTURE

V. A. Chizh *In its* The Uses of Radioact. Isotopes and Nucl. Radiation in the U.S.S.R. Vol. III: Machine Bldg., Met. 1966 p 89–97 (See N67-21221 10-15) CFSTI: HC $3.00/MF $0.65

Sulfur 35 and phosphorus 32 were used to study the crystal structure of steel in centrifugally cast hollow tube blanks, as well as the redistribution of the sulfur and phosphorus due to hot rolling. Counting particles was not a satisfactory method because the sulfur distribution was nonuniform, and so that contact radiography was, therefore used. No coring occurred in the sulfur in the cross section or along the tube casting walls; and although phosphorus distribution was changed by hot rolling, its banded coring was not completely cancelled. Migration of sulfur from different sources is tabulated, as are the weight amounts of sulfur penetrating into the welded metal from these sources. Studies are also reported relating to phosphate, oxalate, and other tube coatings; and it is shown that strongly deformed coatings approach one another with respect to their adsorptivities for a soap solution at increasing degrees of deformation. The method of labeled atoms also permits fairly accurate determination of degree of degreasing of tubes in an alkaline solution. M.W.R.

N67-21243# Israel Program for Scientific Translations, Ltd., Jerusalem.

SCINTILLATION METHOD OF GAMMA FLAW DETECTION

A. A. Arkhangel'skii *In its* The Uses of Radioact. Isotopes and Nucl. Radiation in the U.S.S.R. Vol. III: Machine Bldg., Met. 1966 p 98 (See N67-21221 10-15) CFSTI: HC $3.00/MF $0.65

Studies are being made to improve the gammagraphs that result from gamma flaw detection procedures by a scintillation method. The method employs a narrow collimated beam of gamma rays, and the machine component under inspection is moved with respect to the beam. Scintillation counters permit the automation of the inspection procedure, eliminate the necessity for prolonged exposures and photographic processing, and can be used in flow-line production processes. M.W.R.

N67-21244# Israel Program for Scientific Translations, Ltd., Jerusalem.

CERTAIN MEANS FOR IMPROVING THE SENSITIVITY OF THE PHOTOGRAPHIC METHOD OF GAMMA FLAW DETECTION

K. G. Goryacheva *In its* The Uses of Radioact. Isotopes and Nucl. Radiation in the U.S.S.R. Vol. III: Machine Bldg., Met. 1966 p 99–104 (See N67-21221 10-15) CFSTI: HC $3.00/MF $0.65

Improving the sensitivity of industrial inspection methods via gamma flaw detection is considered in terms of materials used and filter arrangements. Sensitivity was improved for very small flaw detection through the use of lead foils, with greatest improvement noted in gammagraphs of articles of more than 40 mm thickness. The use of lead filters improves sensitivity of gammagraphs for steel articles of between 10 to 20 mm thickness, but for thicker articles no change in sensitivity was observed. M.W.R.

N67-21245# Israel Program for Scientific Translations, Ltd., Jerusalem.

THE URM-1 GAMMA UNIT FOR THE INSPECTION OF WELDED JOINTS AND CASTINGS WITH GAMMA RAYS FROM Ir^{192} AND $Eu^{152,154}$

V. Dzhabadari *In its* The Uses of Radioact. Isotopes and Nucl. Radiation in the U.S.S.R. Vol. III: Machine Bldg., Met. 1966 p 105–107 (See N67-21221 10-15) CFSTI: HC $3.00/MF $0.65

A mobile flaw detection unit that can use iridium 192, europium 152, and europium 154 as gamma sources is employed in laboratory, shop, and field testing. Lead of 85 mm thickness provides protection against radiation hazards from this gamma unit that can inspect thick steel castings of intricate shape, precision steel castings, welded machine components, and welded structures during overhauling. Simultaneous inspection can be made of more than one article; and cavities, incomplete fusion, pores, and inclusions can be detected. M.W.R.

N67-21246# Israel Program for Scientific Translations, Ltd., Jerusalem.

INSPECTION OF WELDED SEAMS BY GAMMA FLAW DETECTION AT THE PLANT IM. F. E. DZERZHINSKII

V. N. Uzlyuk *In its* The Uses of Radioact. Isotopes and Nucl. Radiation in the U.S.S.R. Vol. III: Machine Bldg., Met. 1966 p 108–110 (See N67-21221 10-15) CFSTI: HC $3.00/MF $0.65

Gamma flaw detection procedures with cobalt 60 and iridium 192 are being used for inspection of blast furnace jackets, steel pouring ladles, air collectors, pipelines operating under pressure, bridge cranes, and other structures. The gamma source is fastened at the focal length of 400 mm by a special bracket that offers considerable protection against radiation hazards to the operator. Results are included for the inspection of welded seams for air tanks and natural gas pipelines. It is noted that the use of iridium 192 provides a considerable weight reduction in the container used for inspection purposes, and that radioactive isotope inspection methods effect considerable money savings. M.W.R.

N67-21248# Israel Program for Scientific Translations, Ltd., Jerusalem.

USE OF RADIOISOTOPES AT THE KUZNETSK METALLURGICAL WORKS

N. G. Bogdanova and A. I. Borodulin *In its* The Uses of Radioact. Isotopes and Nucl. Radiation in the U.S.S.R. Vol. III: Machine Bldg., Met. 1966 p 121–125 (See N67-21221 10-15) CFSTI: HC $3.00/MF $0.65

Radioisotope methods and uses are described in connection with blast furnace, steel-smelting, rolling and coking plants; production of refractories and agglomerates; and chemical analysis of various steels. It is noted that radioisotopes are used throughout the manufacturing processes, for detection as well as control and automation purposes. Working with isotopes has improved technology and the quality of production, reduced the number of rejects that are produced, increased productivity of various metallurgical machines, and automated the control of processing. Results are related to a specific metallurgical establishment. M.W.R.

N67-21249# Israel Program for Scientific Translations, Ltd., Jerusalem.

RADIOISOTOPES IN STUDIES OF PRODUCTION TECHNOLOGY AT THE AZOVSTAL' PLANT

M. T. Bul'skii, O. I. Val'ter, A. M. Skrebtsov, V. A. Kostyuk, F. F. Sviridenko et al *In its* The Uses of Radioact. Isotopes and Nucl. Radiation in the U.S.S.R. Vol. III: Machine Bldg., Met. 1966 p 126–129 (See N67-21221 10-15) CFSTI: HC $3.00/MF $0.65

Use of gamma and beta emitting units are considered for blast furnace, steel smelting, and rolling processes; as well as for gamma flaw detection for the inspection of weldments. Mention is made of inspections made while blast furnaces are under repair, and attempts to use smaller quantities of radioactive phosphorus 32 are made in experiments both blast and open hearth furnaces. M.W.R.

N67-21250# Israel Program for Scientific Translations, Ltd., Jerusalem.

THE USE OF RADIOISOTOPES IN THE BLAST FURNACE SHOP OF THE METALLURGICAL PLANT IM. F. E. DZERZHINSKII

I. G. Polovchenko, P. L. Gruzin, V. N. Afanes'ev, and A. G. Vasil'ev *In its* The Uses of Radioact. Isotopes and Nucl. Radiation in the U.S.S.R. Vol. III: Machine Bldg., Met. 1966 p 130–137 (See N67-21221 10-15) CFSTI: HC $3.00/MF $0.65

Varied uses of radioisotopes for the inspection and control of blast furnace processes are described. Determination can be made of gas flow velocities and the length of times the charged components stay in the blast furnace. Checking the wear of the hearth and crucible of blast furnaces is discussed, as are the movement of the charge in the furnace, the radiometric inspection of the level of stock in a blast furnace, and the control of charge loading. Radiometric control of the properties of the charge materials is considered, and a radiometric device is shown that inspects the size of coke lumps. M.W.R.

N67-21251# Israel Program for Scientific Translations, Ltd., Jerusalem.

RADIOISOTOPES AT THE METALLURGICAL PLANT IM. IL'ICH

Yu. P. Belyaev *In its* The Uses of Radioact. Isotopes and Nucl. Radiation in the U.S.S.R. Vol. III: Machine Bldg., Met. 1966 p 138–141 (See N67-21221 10-15) CFSTI: HC $3.00/MF $0.65

A general description of the blast furnace operation and steel making, with specific attention to radioactive research methods employed to automate and control the necessary operations, is presented. Phosphorus 32 was used to study the movement of molten cast iron in the crucible of a large furnace, and zirconium 95 was used to study the basic factors affecting the process of sulfur exchange between cast iron and slag. Work is underway to develop a radioactive instrument to determine the percentage content of iron in ores used in the blast furnaces, and sulfur 35 is used to study the thermodynamic activity of sulfur in molten metal slag in order to reduce the actual sulfur content. Layout of the laboratory conducting radioactive research is presented. M.W.R.

N67-21252# Israel Program for Scientific Translations, Ltd., Jerusalem.

INTRODUCTION OF RADIOACTIVITY INSTRUMENTS INTO INDUSTRIAL PRACTICE

V. A. Machkovskii and E. S. Shlyakhovetskii *In its* The Uses of Radioact. Isotopes and Nucl. Radiation in the U.S.S.R. Vol. III: Machine Bldg., Met. 1966 p 142 (See N67-21221 10-15) CFSTI: HC $3.00/MF $0.65

Mention is made of several radioactive instruments that have found practical applications in a blast furnace operation. A device removes water from the scrubber during high pressure operation of the furnace, and a level gauge was introduced in the intermediate processing vessel to check the boundary between liquid and gaseous ammonia. Such instruments can check the stream of slurry removed from multicyclones of the agglomeration plant, determine the completeness of fuel combustion in the boilers of the central power plant, and be used for marking welded joints of hot-rolled metal during the rolling of continuous strip coils. M.W.R.

N67-21253# Israel Program for Scientific Translations, Ltd., Jerusalem.

EXPERIENCE GAINED IN THE APPLICATION OF RADIOACTIVITY INSTRUMENTS OF THE RELAY TYPE TO THE AUTOMATION OF TECHNOLOGICAL PROCESSES AT THE PLANT "SARKANAIS METALLURGS"

A. A. Genis, M. A. Kabo, L. R. Pliner, Ya. M. Sunakslis, T. M. Timbars et al *In its* The Uses of Radioact. Isotopes and Nucl. Radiation in the U.S.S.R. Vol. III: Machine Bldg., Met. 1966 p 143–145 (See N67-21221 10-15) CFSTI: HC $3.00/MF $0.65

Automation of technological processes in a sheet rolling operation is accomplished by the use of control instruments that use beta radiation source. Sheet removal is thereby accomplished, and a blocking device is used on the cold shears of the rolling mill. Introduction of radioactive control methods has resulted in savings of manpower and money, improved working conditions, and simplicity in servicing the machinery. M.W.R.

N67-21254# Israel Program for Scientific Translations, Ltd., Jerusalem.

RADIOMETRIC TRANSDUCERS IN SYSTEMS FOR CONTROLLING THE LEVEL OF MOLTEN METAL IN THE MOLDS OF CONTINUOUS CASTING MACHINES

A. N. Valov, V. K. Latyshev, V. V. Lyndin, and Yu. S. Pliskin *In its* The Uses of Radioact. Isotopes and Nucl. Radiation in the U.S.S.R. Vol. III: Machine Bldg., Met. 1966 p 146–150 (See N67-21221 10-15 CFSTI: HC $3.00/MF $0.65

Automatic control by radiometric transducers is discussed for maintaining the proper level of molten metal used in continuous steel casting machines. Working principle of the standard level controller is described, and the wiring diagram of the gamma relay is shown. The level of molten metal in the molds can be controlled by adjusting the rate of withdrawal of the casting or by varying the amount of metal fed into the machine; and both of these can be accomplished by the standard level controller. M.W.R.

N67-21255# Israel Program for Scientific Translations, Ltd., Jerusalem.

PROSPECTS FOR THE INTRODUCTION OF INSTRUMENTS WITH GAMMA SOURCES AT THE YUZHNYI ORE-DRESSING WORKS

I. I. Savitskii, M. L. Gol'din, and E. G. Litichevskii *In its* The Uses of Radioact. Isotopes and Nucl. Radiation in the U.S.S.R. Vol. III: Machine Bldg., Met. 1966 p 151–154 (See N67-21221 10-15) CFSTI: HC $3.00/MF $0.65

Studies are described that will permit the automatic loading and unloading of the parabolic bins as well as automatic control of pulp density in an ore-dressing industrial establishment. Gamma relays and other noncontact control devices are discussed, along with the operation performed at the plant. Advantages of the use of radioisotopes for control instruments are improvement of the quality of the ore concentrate, reduction in personnel required for monitoring operations, and overall savings in costs of plant operations. M.W.R.

N67-21256# Israel Program for Scientific Translations, Ltd., Jerusalem.

RADIOISOTOPES AT ENTERPRISES OF THE CHELYABINSK COUNCIL OF NATIONAL ECONOMY

N. B. Buchin and K. V. Fadeev *In its* The Uses of Radioact. Isotopes and Nucl. Radiation in the U.S.S.R. Vol. III: Machine Bldg., Met. 1966 p 155–159 (See N67-21221 10-15) CFSTI: HC $3.00/MF $0.65

Feasibility of using gamma relays in coal mining and preparation was investigated, and several schemes for the installation of gamma electronic relays are reported for the control and automation of various industrial processes. These processes include: (1) checking the loading of the receiving hoppers of the skip hoist and automatic maintenance of the sealing coal plug, (2) preventing the clogging of the discharge chutes of the dressing plants, (3) counting loading mining cars, (4) controlling the track by noncontact devices, (5) determining if coal is on the conveyer belt, and (6) automatic loading of the mine skips. M.W.R.

N67-21257# Israel Program for Scientific Translations, Ltd., Jerusalem.

AUTOMATION OF DRESSING AND AGGLOMERATION EQUIPMENT BY MEANS OF RADIOMETRIC INSTRUMENTS

Ya. M. Ber, Kh. E. Gunne, A. V. Chashchinov, and V. A. Yanushkovskii *In its* The Uses of Radioact. Isotopes and Nucl. Radiation in the U.S.S.R. Vol. III: Machine Bldg., Met. 1966 p 160–162 (See N67-21221 10-15) CFSTI: HC $3.00/MF $0.65

Two cobalt 60 gamma ray sources are used for automatic control of loading the blast furnace bins at a metallurgical plant, and relay units with magnetic amplifiers are found to be the most reliable relay-based radiometric instruments for this purpose. Automation of the technological processes in ore dressing plants is also discussed in terms of radioactive instruments. Protection for the workers is considered, and reduction in number of personnel required and time required for the processes is noted. M.W.R.

N67-21261# Israel Program for Scientific Translations, Ltd., Jerusalem.

AUTOMATION OF TECHNOLOGICAL PROCESSES IN COAL PREPARATION WITH RADIOACTIVITY INSTRUMENTS

A. Z. Kulishenko *In its* The Uses of Radioact. Isotopes and Nucl. Radiation in the U.S.S.R. Vol. III: Machine Bldg., Met. 1966 p 177–183 (See N67-21221 10-15) CFSTI: HC $3.00/MF $0.65

Radiometric instruments used in the control and automation of technological processes in the coal industry are discussed, and safety in coal plants using radioactive apparatus is considered. Noncontact radiometric devices are considered to offer the most satisfactory means of maintaining the constant density of the circulating suspension used in the coal preparation units. Automatic control of the flotation process is detailed, and the principal parameters of coal pulp density and the load on the flotation machine are discussed. M.W.R.

N67-21262# Israel Program for Scientific Translations, Ltd., Jerusalem.

INDUSTRIAL AUTOMATION MEANS BASED ON RADIOACTIVE RADIATIONS IN THE COAL AND ORE MINING INDUSTRIES

V. G. Segalin *In its* The Uses of Radioact. Isotopes and Nucl. Radiation in the U.S.S.R. Vol. III: Machine Bldg., Met. 1966 p 184–186 (See N67-21221 10-15) CFSTI: HC $3.00/MF $0.65

Economic savings effected by the introduction of radioactive means for control and automation of coal and ore mining processes are stressed in a general article based on experiences at several industrial establishments. In coal mines, the reduction in number of servicing personnel required as well as around-the-clock use of equipment and reduction in loss of coal are noted as the advantages of noncontact instrumentation. Specific applications are included. M.W.R.

N67-21263# Israel Program for Scientific Translations, Ltd., Jerusalem.

DETERMINATIONS OF SLAG IN STEEL SMELTING

A. M. Skrebtsov, M. T. Bul'skii, F. F. Sviridenko, and V. A. Kostyuk *In its* The Uses of Radioact. Isotopes and Nucl. Radiation in the U.S.S.R. Vol. III: Machine Bldg., Met. 1966 p 187–189 (See N67-21221 10-15) CFSTI: HC $3.00/MF $0.65

Determination was made of the amount and effect of slag on the intensity of the boiling period of the melting charge and the quality of smelted steel. When radioisotope methods were used as the determinants, the production of first grade rail steel increased by between 0.3 and 0.4%. Yield of rails is graphed as a function of the amount of slag in the furnace during the pre-boiling period, and the input-output ratio for low carbon steel is shown as a function of the amount of slag before the tapping of the heat. M.W.R.

N67-21265# Israel Program for Scientific Translations, Ltd., Jerusalem.

AUTOMATION OF HYDRAULIC DUST-REMOVAL UNITS

A. T. Lebedev *In its* The Uses of Radioact. Isotopes and Nucl. Radiation in the U.S.S.R. Vol. III: Machine Bldg., Met. 1966 p 193 (See N67-21221 10-15) CFSTI: HC $3.00/MF $0.65

A gamma relay is used to automate the hydraulic dust removal units in the ore dressing plant of a metal works complex. Sensitivity of the relay, whose operation is based on the variation of gamma absorption in media of different densities, is through 2 or 3 cm of ore layer. M.W.R.

N67-21266# Israel Program for Scientific Translations, Ltd., Jerusalem.

RADIOMETRIC CONTROL OF THE DEGREE OF FRITTING AND WEAR OF THE HEARTH OF OPEN-HEARTH FURNACES

V. A. Machkovskii and M. M. Khil'ko *In its* The Uses of Radioact. Isotopes and Nucl. Radiation in the U.S.S.R. Vol. III: Machine Bldg. Met. 1966 p 194 (See N67-21221 10-15) CFSTI: HC $3.00/MF $0.65

The processes of fritting and wear of the hearths in open hearth furnaces was investigated by beta emissions from calcium 45, phosphorus 32, and strontium 89. Fritted layers up to 50 mm thick were most resistant, and at greater thicknesses there was a sharp increase in wear rate. Results indicate that the fritting layer of hearths should be burnt in at the maximum possible temperature, with scale used as the slagging unit. Heating of the magnesite layer for more than 40 or 50 minutes is found to be inefficient. Radiometric control methods resulted in a 40 minute reduction in in time required for hot patching of furnace hearths, and this was estimated to yield an annual increase of 20,000 tons in steel production. M.W.R.

N67-21267# Israel Program for Scientific Translations, Ltd., Jerusalem.

CHECKING THE SINTERING OF AGGLOMERATES BY MEANS OF RADIOISOTOPES

A. V. Pugachev *In its* The Uses of Radioact. Isotopes and Nucl. Radiation in the U.S.S.R. Vol. III: Machine Bldg., Met. 1966 p 195–197 (See N67-21221 10-15) CFSTI: HC $3.00/MF $0.65

Development of a continuous monitoring process for sintering agglomerates is accomplished by placing cesium 137 gamma sources directly on the agglomeration machine. Continuous control makes it possible to have automatic inspection of the working rate of the machine. The scheme for checking the sintering process is outlined, and various experiments relating to placement of the radioisotopes are described. M.W.R.

N67-21268# Israel Program for Scientific Translations, Ltd., Jerusalem.

FEASIBILITY OF USING INCOMPLETELY BURNT LIME INSTEAD OF LIMESTONE IN THE CHARGE OF OPEN-HEARTH FURNACES

A. M. Skrebtsov, V. I. Alekseev, L. A. Shvartsman, M. T. Bul'skii, A. I. Osipov et al *In its* The Uses of Radioact. Isotopes and Nucl. Radiation in the U.S.S.R. Vol. III: Machine Bldg., Met. 1966 p 198–202 (See N67-21221 10-15) CFSTI: HC $3.00/MF $0.65

Use of lime instead of limestone did not appreciably improve the technological parameters for smelting phosphorous pig iron. It is expected that increasing the content of active calcium oxide in the lime will offer no improvements and; at the same, time, will increase production costs. The cost of one ton of incompletely burnt lime is more than three times that of limestone. Studies using calcium 45 and cobalt 60 were made of the rates of fusion of scrap, slag formation, and dephosphorizing when the limestone in the charge was replaced with lime. Determination was made of the relationship of the time required for smelting and (1) the quantities of lime or limestone and (2) residual slag in the charge. Phosphorus 32 was used to determine the residual slag, and these results were compared with those from studies that did not use the radioisotopes. M.W.R.

N67-21269# Israel Program for Scientific Translations, Ltd., Jerusalem.

DETERMINATION OF NONMETALLIC INCLUSIONS IN RAIL STEEL BY MEANS OF RADIOISOTOPES

A. M. Skrebtsov, F. F. Sviridenko, V. A. Kostyuk, and A. N. Popova *In its* The Uses of Radioact. Isotopes and Nucl. Radiation in the U.S.S.R. Vol. III: Machine Bldg., Met. 1966 p 203–205 (See N67-21221 10-15) CFSTI: HC $3.00/MF $0.65

Contamination from nonmetallic inclusions in rail steel was studied with radioisotopes for the following points in the production process: (1) furnace slag, (2) exothermic compound added to the riser of the ingot, (3) refractory coating of the sinkhead, (4) rubbish in the ladle, and (5) refractory stopper of the steel tap hole. The quantity of extraneous inclusions in steel was determined radiographically by calcium 45; and the sources of the nonmetallic inclusions were studied with barium 131, phosphorous 32, and strontium 89. Chemical analysis showed the average content of nonmetallic inclusions to be 0.00012 g per 1 g of steel. Attention is recommended to the cleaning of ladles, ingot molds, and troughs; and these refractories must possess high mechanical resistance to corrosion by liquid steel. M.W.R.

N67-21272# Israel Program for Scientific Translations, Ltd., Jerusalem.

STUDIES OF THE METAL DEFORMATION IN ROLLING BY MEANS OF RADIOISOTOPES

O. I. Valiter, V. A. Kostyuk, N. P. Kologrivov, and Z. A. Yashchenko *In its* The Uses of Radioact. Isotopes and Nucl. Radiation in the U.S.S.R. Vol. III: Machine Bldg., Met. 1966 p 211–213 (See N67-21221 10-15) CFSTI: HC $3.00/MF $0.65

Phosphorus 32 was used to study the nature of deformation of metal being rolled into rails. Batch introduction of the radioisotope into the molten metal made it possible to obtain several zones during the crystallization period. Studies were made of the rolling of a rail from an ingot weighing 9.76 tons, as well as of the rolling of a symmetrical I-beam section from an ingot of killed steel weighing 6.75 tons. Data given for the absolute and relative area reductions of the individual crystallization zones are considered of practical interest to roll-pass designers. M.W.R.

N67-21273# Israel Program for Scientific Translations, Ltd., Jerusalem.

MEASUREMENT OF LOW RADIOACTIVITIES IN METAL SAMPLES

B. N. Vasichev, A. N. Valov, and Yu. S. Pliskin *In its* The Uses of Radioact. Isotopes and Nucl. Radiation in the U.S.S.R. Vol. III: Machine Bldg., Met. 1966 p 214–217 (See N67-21221 10-15) CFSTI: HC $3.00/MF $0.65

A sodium iodide scintillation counter activated with large thallium crystals is considered to have 80% efficiency for recording gamma radiation from cobalt 60. Increasing the efficiency of the counter and calculating the self-absorption in the metal sample are discussed, as is minimizing the measurement error. The unit described contains two 2π counters with disk sample between them and with delay of pulses from the second counter. A stable condition is obtained when the ruthenium 103 is converted by gamma disintegration to rhodium 103. Means of suppressing background in the counter are noted. M.W.R.

N67-21275# Israel Program for Scientific Translations, Ltd., Jerusalem.

APPLICATION OF RADIOISOTOPES TO AUTOMATION OF THE SIZE-REDUCTION AND CLASSIFICATION CYCLE IN ORE-DRESSING

A. T. Lebedev *In its* The Uses of Radioact. Isotopes and Nucl. Radiation in the U.S.S.R. Vol. III: Machine Bldg., Met. 1966 p 220–221 (See N67-21221 10-15) CFSTI: HC $3.00/MF $0.65

A remote control automation scheme is considered that can improve the parameters of the pulp and provide optimum conditions for size reduction in an ore dressing plant. Optimum loading of ore into the mill and optimum water-ore ratio are maintained by this automatic radiometric scheme, which contains a special pulse counting attachment. Diagrams indicate that there is less variation in the pulp density of the overflow, as measured by a radiometric gauge with proportional and float control, when the pulse attachment is used. M.W.R.

N67-21276# Israel Program for Scientific Translations, Ltd., Jerusalem.

DETERMINATION OF THE BULK WEIGHT OF COAL CHARGE WITH GAMMA RAYS

I. G. Zubilin and M. L. Gol'din *In its* The Uses of Radioact. Isotopes and Nucl. Radiation in the U.S.S.R. Vol. III: Machine Bldg., Met. 1966 p 222–226 (See N67-21221 10-15) CFSTI: HC $3.00/MF $0.65

Gamma radiation from cobalt 60 is used to determine the bulk weight of the coke charge in ovens in order to improve the quality of coke output. Chemical compositions are given for several grades of coal and the charge; and experimental and calculated mass absorption coefficients are compared for both the coals and the charge. Graphs depict the relationship of absorption of a narrow beam of gamma rays with the density of coal charge, as well as the intensity of gamma radiation from cobalt 60 and the density of the coal charge. Results are shown for both a dry charge and for the same charge with a 10 wt % moisture content. M.W.R.

N67-21325# Rock Island Arsenal Lab., Ill. Research and Engineering Div.

AN EVALUATION OF THE SPIRAL POINT DRILL GEOMETRY

George F. Wilson and James J. Weintraut Sep. 1966 34 p refs

(RIA-TR-66-2930; AD-644303) CFSTI: HC $3.00/MF $0.65

The spiral point drill geometry was evaluated in comparison with the conventional chisel point drill grind with respect to drill life and hole quality. Drills of 1/4, 1/2 and 3/4 inch diameter were used to produce one inch deep holes in FS 4140 steel quenched and tempered to Rockwell C 32 plus or minus 2. The spiral point drills, when sufficient provision was made for chip ejection, had greater life, and produced straighter, more concentric holes than chisel point drills. The successful use of the spiral point geometry required high quality drills produced to close tolerances. The preparation of the spiral point grind is more time consuming. In some cases where hole tolerances and finish requirements are not close, but are beyond the capabilities of the chisel point drill, the spiral point drill can be used to advantage to eliminate spot drilling or the use of guide bushings. Author (TAB)

N67-21354# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

GLUE-WELD JOINTS IN MACHINE BUILDING

G. G. Kanter, V. N. Shavyrin, N. Kh. Andryev, and L. S. Fel'dman 26 May 1966 154 p refs Transl. into ENGLISH of the book "Kleyesvarnyye Soyedineniya v Mashinostroyenii" Kiev, 1964 p 1-200

(FTD-MT-65-279; TT-67-60317; AD-644146) CFSTI: HC $3.00/MF $0.65

The book contains generalized results of scientific research and experimental work on the use of glued and welded joints in strengthening structure from highly durable aluminum alloys. The basic attention is allotted to the technology of the manufacture of glue-weld joints, the development of the glue compositions, application of glues, preparation of the surface for welding, anticorrosive protection of glue-weld joints and also the creation of means of mechanization and automation of the technology process of manufacture of glue-weld joints and the determination of technical and economic indices. Comparative characteristics of the strength of welded and glue-weld joints under static and cyclic loads in conditions of normal and raised temperatures are given. Author (TAB)

N67-21421# Union Carbide Corp., Oak Ridge, Tenn. Nuclear Div.

MACHINING AND FINISHING FINE-GRAIN BERYLLIUM

V. M. Hovis 12 Oct. 1966 34 p refs

(Contract W-7405-ENG-26)

(Y-1551) CFSTI: HC $3.00/MF $0.65

A capability has been established for machining and finishing complex structural components of high-strength, fine-grain beryllium. Precision fabrication has been made possible by using a combination of conventional machining and chemical-etching techniques. Optimum strength properties in the components have been assured by the chemical-etching step, which can be accomplished with predictable results. Through the use of consumable specimens and careful use of a nondestructive replica technique, a usable method for certifying the optimum strength conditions of beryllium components has been developed. Author

N67-21427# Utah Univ., Salt Lake City. Dept. of Chemistry.

ELECTROPLATING COBALT-60 WITHOUT RESIDUE

Carl J. Christensen and Andrew T. Jacobsen Jun. 1966 15 p refs *Its* Bull.-139, Vol. 57, no. 20

(Contract DA-42-007-403-CML-453)

(AD-644620) CFSTI: HC $3.00/MF $0.65

The article describes the production of 1/8 inch diameter magnetic pellets with uniformly contained Co-60 at the level of 1.0 plus or minus 0.2 curie per pound. Since these radioactive pellets were to be mechanically handled their protection against abrasion and corrosion was necessary. This was accomplished by plating a layer of nickel over the cobalt followed by a layer of cadmium on the outside of the pellet. The product was entirely satisfactory for the intended use, and many other uses can be conceived for a product of this nature, it being possible to fabricate from such pellets radiation sources of specified intensity and shape. The product is stable in most enviornments against removal of cobalt-60 either by abrasion or by chemical corrosion. By making heavy platings and by using an active nickel anode substantially all the Co(++) can ultimately be plated out of the residual bath onto the iron pellets. This comes about because Co and Ni will plate out as an alloy with the plating being cobalt rich as compared to the electrolyte. Using a suitable cell or cave, now extensively used in radiation laboratories, one can carry out the operation without hazard to the operating personnel. TAB

N67-21498# California Univ., Berkeley. Lawrence Radiation Lab.

SELECTION OF A GETTER MATERIAL AND MODE OF OPERATION

James N. Doggett and George E. Vogtlin 30 Sep. 1966 14 p Presented at the Symp. on Eng. Probl. of Controlled Thermonucl. Res., Gatlinburg, Tenn., 3-6 Oct. 1966 Submitted for publication

(Contract W-7405-ENC-48)

(UCRL-70028; CONF-661016-19) CFSTI: HC $3.00/MF $0.65

An investigation was made to optimize the operation of Ti getters in the center section of the 2X Multiple Compression Experiment. The center section consists of a piece of 18-in.-dia glass pipe 13 ft long connecting end chambers 25 ft in dia by 10 ft long. The glass section has twelve 1-1/4-in.-dia diagnostic ports. Three of these ports along with end openings were made available for getters. Three materials were tested: Ti wound on W cable, a commercially wound filament, and an 85% Ti-15% Mo wire. NSA

N67-21520*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

THE FABRICATION OF BERYLLIUM. VOLUME VI: JOINING TECHNIQUES FOR BERYLLIUM ALLOYS

R. F. Williams and S. E. Ingels Jul. 1966 273 p refs

(NASA-TM-X-53453) CFSTI: HC $3.00/MF $0.65 CSCL 13H

Joining techniques are investigated and developed for the fabrication of beryllium aerospace vehicle structures. The feasibility of utilizing high-strength mechanical fasteners, including Huckbolts and Jo-bolts, adhesive bonding, and a combination of adhesive bonding and mechanical fasteners for the fabrication of beryllium structures was investigated. Preliminary evaluations of brazing and diffusion bonding, as assembly methods, also were made. The primary objective of this investigation, however, was the development of basic parameters for the assembly of beryllium components with mechanical fasteners. The results indicate that the investigated methods are feasible, and that large beryllium structures can be fabricated if the details of the joint geometry and of the installation processes are observed. High efficiency mechanical joints can be fabricated on a production basis. Author

N67-21564# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.

FIBER REINFORCED METAL MATRIX COMPOSITE STUDIES

R. K. Robinson 25 Oct. 1966 39 p Presented at the Am. Soc. for Metals Natl. Metal Exposition and Congr., Chicago, 31 Oct.-3 Nov. 1966

(Contract AT(45-1)-1830)

(BNWL-SA-550; CONF-661031-1) CFSTI: HC $3.00/MF $0.65

A high energy-rate forming process used to consolidate and shape composite, refractory metal, and ceramic materials is described. Thirteen fiber reinforced-metal matrix systems are discussed. Fibers such as SiC whiskers, Al_2O_3 whiskers, B filaments, and W filaments were combined in one or more Ti, Ni, Al, stainless steel, Mo, and W metal matrices. Observations concerning the microstructure and bulk mechanical properties of composite materials formed by the high energy-rate process are briefly described. Author (NSA)

N67-21587# General Electric Co., Schenectady, N. Y. Knolls Atomic Power Lab.
CHEMICAL AND ELECTROCHEMICAL MILLING OF SPIRAL LANDS ON ZIRCALOY TUBING
P. G. Lozier, W. C. Oaks, and M. R. Birnby 15 Aug. 1966 13 p
(Contract W-31-109-ENG-52)
(KAPL-3159) CFSTI: HC $3.00/MF $0.65

Work was performed to determine the feasibility of milling spiral lands for spacers on Zircaloy tubing by chemical and electrochemical means. Four spiral integral protrusions (lands) were formed on heavily cold-worked Zircaloy-4 tubing. The lands were 40 mils wide and 7.5 mils high. The tube material between the lands was removed by chemical or electrochemical dissolution. For the chemical dissolution study, the areas of the desired protrusions were masked, and the tubing was then immersed in a pickling solution (HNO_3–HF). Electrochemical milling with use of a saturated solution of NaCl in water and high current density (400 amps/in.^{2}), provided another means of forming the tube to the desired shape and dimensional tolerances. Although large quantities of this tubing were not formed, it was estimated that the electrochemical milling process would be economically feasible. NSA

N67-21659# Union Carbide Corp., Oak Ridge, Tenn. Y-12 Plant.
CARBIDE TOOLS—THEORY AND PRACTICE
John S. Hurst 29 Nov. 1966 27 p refs
(Contract W-7405-ENG-26)
(Y-DA-1412) CFSTI: HC $3.00/MF $0.65

Methods for preparing and processing sintered carbides for tools are presented. Capabilities of carbide tools, when compared with metal-cutting tools, are discussed and guides for selection of tools for various applications are defined. Benefits and disadvantages of additions of carbides of Ti, Ta, Nb, and other metals, to straight W–Co grades are evaluated, as are the effects of Co content and grain size. Precautions to be observed in both laboratory and production tests are summarized and the importance of tool geometry and tool insert mounting is stressed. NSA

N67-21719# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
MATHEMATICAL MODEL AND CALCULATOR FOR OPTIMUM DIVISION OF ROLLED MATERIAL
P. Caslavsky and A. Vanecek 27 Sep. 1966 12 p refs Transl. into ENGLISH from Hutnicke Listy (Prague), no. 10, 1964 p 711–714
(FTD-HT-66-163; AD-643967) CFSTI: HC $3.00/MF $0.65

Contents: System of optimum division, Mathematical model, Control of an optimalization counter. TAB

N67-21744# Royal Aircraft Establishment, Farnborough (England).
THE STRENGTH OF BONDED SINGLE-LAP METAL JOINTS AT LOW AND HIGH TEMPERATURES AND AFTER TEMPERATURE CYCLING [DIE FESTIGKEIT VON UBERLAPPTEN METALLKLEBUNGEN BEI TIEFEN UND HOHEN TEMPERATUREN UND NACH TEMPERATUR-WECHSELN]
W. Althof Nov. 1966 45 p refs Transl. into ENGLISH from the German
(RAE-LIB-TRANS-1189) CFSTI: HC $3.00/MF $0.65

Bonded single-lap joints have been tested at temperatures from −195°C to +300°C for short- and long-time loading and after temperature cycles between −25°C and +90°C or +150°C. The test results are useful for the selection of adhesives acting in selected temperature ranges. Correlations between the shear strength and the joint factor have been established. Author

N67-21779# Tokyo Univ. (Japan). Inst. of Industrial Science.
FUNDAMENTAL APPROACHES TO CONTROL OF POWDER FLOWS
Tadashi Yamashita and Mashiro Mori Repr. from Rept. Inst. Ind. Sci. Univ. Tokyo (Japan), v. 17, no. 1, Nov. 1966 p 1–50 refs In JAPANESE; ENGLISH summary *Its* Serial No. 108
CFSTI: HC $3.00/MF $0.65

Problems associated with flow are investigated from the viewpoint of control engineering. The stationary flow rate of polyvinyl chloride powder from the powder vessels is discussed, and the factors affecting the flow rate are classified. Then the degree of effect of each factor on flow rate is studied quantitatively. Generally speaking, the flow rate of powder from a vessel packed with some volume of powder changes with the lapse of time. It initially increases; after some time passes it becomes a constant rate determined by the diameter of outlet; and finally it increases again, then flow out is finished. The control method of powder flow by gas fluidization method is discussed systematically. The relationship between gas pressure and flow rate of powder in a combination device of a hopper and an air slide (horizontal fluidizing trough) is examined. One of the major conclusions is that the mean velocity of powder in a trough is proportional to the feed velocity. The value of the proportional coefficient is a function of a gas pressure, i.e., by increasing pressure the value increases but saturates at some constant value. S.P.

N67-21802# Oerlikon Elektrodenfabrik Eisenberg G.m.b.H. (West Germany).
INVESTIGATION WITH REGARD TO THE BREAKING STRENGTH OF WELDMENTS ON HEAVY GAGE TENSILE STEELS, ON THE BASIS OF FRACTURE CRITERIA WHICH ARE IN TURN BASED ON THE EFFECT OF THE DEFORMATION VELOCITY Quarterly Report, Sep. 1–Dec. 31, 1965
H. Schnadt 31 Dec. 1965 10 p
(Contract EURATOM-049-65/9-TEED)
(EURAEC-1612; EUR-2825; QR-1)

Initial preparations for the research are reported. Inventory steels and weldings, and arrangements for measurements to be performed outside the laboratory are reported. Preliminary investigations on notch sharpness and thermo-vector regions are mentioned. N.E.N.

N67-21849# Frankford Arsenal, Philadelphia, Pa.
IMPROVED CARTRIDGE DESIGN—ULTRASONIC WELDING Report, Nov. 1965–May 1966
George P. Miller Wright-Patterson AFB, Ohio, Systems Eng. Group. Oct. 1966 35 p refs
(FA-R-1828; SEG-TR-66-44; AD-645273) CFSTI: HC $3.00/MF $0.65

Ultrasonic welding was investigated for development of an all metal cartridge utilizing the minimum number of parts and procedures. Feasibility was established by welding a circular disc to the open end of a cylindrical cartridge. Loaded cartridges were satisfactorily welded, though more development is desirable to improve assembly procedures. Author (TAB)

16 MASERS

Includes applications of masers and lasers. For basic research see: 26 Physics, Solid State.

N67-20404* Massachusetts Inst. of Tech., Cambridge.
A STUDY OF THE ATMOSPHERIC EFFECTS ON INTENSITY SPATIAL AND TEMPORAL PROPERTIES AT 6328A
James Eugene Roberson (M.S. Thesis) Feb. 1967 28 p refs
(Grant NsG-334)
(NASA-CR-83052) CFSTI: HC $3.00 CSCL 20F

The effects of turbulence on the intensity of a collimated beam transmitted through the atmosphere are considered. Focused on are the intensity statistics at a point, the spatial intensity correlation function, and the time crosscorrelation function of intensity. Expected theoretical results are examined, and results of experimental studies over a 4,000 meter atmospheric channel are presented. Author

N67-20449 Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
MOSCOW UNIVERSITY HERALD. SERIES III. PHYSICS, ASTRONOMY
7 Dec. 1966 13 p refs Transl. into ENGLISH from Vestn. Mosk. Univ., Ser. III: Fiz.-Astron. (Moscow), vol. 20, no. 5, 1965 p 89–92
(FTD-HT-66-276; TT-67-60191; AD-643625) CFSTI: $3.00

CONTENTS:

1. CIRCUITS OF PARAMETRON FREQUENCY DIVIDERS V. P. Komolov p 1–5 refs (See N67-20450 10-09)

2. NARROWING OF EMISSION BAND OF A RUBY LASER WITH A COMPLEX RESONATOR F. A. Korolev and S. M. Mamedzade p 6–7 ref (See N67-20451 10-16)

N67-20451 Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
NARROWING OF EMISSION BAND OF A RUBY LASER WITH A COMPLEX RESONATOR
F. A. Korolev and S. M. Mamedzade *In its* Moscow Univ. Herald. Ser. III. Phys. Astronomy 7 Dec. 1966 p 6–7 ref (See N67-20449 10-16) CFSTI: HC $3.00

The feasibility of creating multiple interference light filters, consisting of two simple interference filters with almost equal effective thicknesses, is shown. One can fade out the maxima of the passage of each of the filters. By using this principle, a narrowing of the band of a ruby laser's radiation with a multiplex resonator may be obtained. Author

N67-20561# Edgerton, Germeshausen and Grier, Inc., Bedford, Mass.
STUDY OF A MULTI-PULSE LASER RANGE FINDER
Sumner Ackerman and Thomas S. Morrison 20 Oct. 1966 62 p refs
(Contract AF 19(628)-5516)
(EG&G-B-3434; AFCRL-66-755; SR-2; AD-642447) CFSTI: HC $3.00/MF $0.65

A programmed multi-pulse optical radar range finder is analyzed. An experimental multi-pulse laser has been developed and its characteristics are described. If the target is optically 'smooth', or is well resolved by the receiver, the multi-pulse range finder has an effective power gain slightly less than its output energy gain when the noise level is low and the detection probability is high. The useful energy gain of a ruby laser due to multi-pulsing was experimentally measured as about 8 db. Under the conditions of geodetic satellite ranging, the target is generally optically 'rough' in the extreme; then the multi-pulse range finder has a power gain of from 10 db to over 25 db, depending on the relative transmitter efficiencies and the acceptable detection probability. This significant increase in the advantage of the multi-pulse system results from the detection statistics that are valid when signal scintillation due to the target is present. Author (TAB)

N67-20681# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
LASERS ON A CONVEYER
L. Lisovskiy and M. Stel'makh 27 Sep. 1966 6 p Transl. into ENGLISH from Izv. (Moscow), 29 Apr. 1965 p 4
(FTD-HT-66-228; AD-644047) CFSTI: HC $3.00/MF $0.65

Presently started is the manufacture of four types of gas lasers which give irradiation in visible and infrared areas of the spectrum with a power of fractions of a milliwatt to 15 milliwatts. Semiconductor quantum generators are compact, wheir weight is considerably lower, than other types of optical quantum generators, but the require cooling with liquid nitrogen. Gaseous and semiconductor lasers pertain to the category of 'little power' ones. Much more intensive is the beam of light given by lasers with solid active substance, for example, ruby or special glass. TAB

N67-21344# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
A METHOD OF SUMMING THE POWER IN LASERS WITH EACH OF THEM WORKING COHERENTLY
M. Ye. Zhabotinskiy and G. A. Vasneva 9 Sep. 1966 6 p Transl. into ENGLISH from Russian Patent No. 172357 (Appl. No. 830263/26-25, 11 Apr. 1963) 2 p
(FTD-HT-66-107; AD-644042) CFSTI: HC $3.00/MF $0.65

The method of summing the power in lasers when each of them is working coherently is different in that to increase the power and directivity of emission of the lasers, part of the beam is selected, sequentially distributed between neighboring lasers and, to scan the main lobe of the emission diagram, it is sent to phase inverters placed in the output beams of the lasers. Author (TAB)

17 MATERIALS, METALLIC

Includes cermets; corrosion; physical and mechanical properties of materials; metallurgy; and applications as structural materials. For basic research see: 06 Chemistry. For related information see also: 18 Materials, Nonmetallic; and 32 Structural Mechanics.

N67-20474 Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
PHASE COMPOSITION, STRUCTURE, AND PROPERTIES OF ALLOY STEELS AND ALLOYS Selected Articles
30 Apr. 1966 64 p refs Transl. into ENGLISH from the book "Fazovyy, Sostav, Struktura i Svoystva Legirovannykh Staley i Splavov" Moscow, Izd. Mashinostr., 1965 p 5–19; 28–38; 39–47; 202–210
(FTD-MT-66-18; TT-67-60299; AD-644038) CFSTI: $3.00

CONTENTS:

1. CERTAIN QUESTIONS OF ANALYSIS OF ISOLATED PHASES AND PHASE COMPOSITION OF ALLOYS N. F. Lashko p 1–21 refs (See N67-20475 10-17)

2. PHASE-SHIFT ANALYSIS OF ALLOYS OF TYPE E1437B WITH VARIABLE CARBON CONTENT N. I. Blok, N. F. Lashko, and K. P. Sorokina p 23–35 refs (See N67-20476 10-17)

3. SURFACE OXIDATION AND PHASE CHANGE IN HEAT-RESISTING NICKEL ALLOYS IN LOADED STATE N. I. Blok, N. F. Lashko, G. I. Morozova, and E. M. Radetskaya p 37–46 refs (See N67-20477 10-17)

4. PHASE COMPOSITION OF SURFACE LAYERS OF HEAT-RESISTING ALLOYS AFTER HEATING IN DIFFERENT MEDIA M. N. Kozlova, N. F. Lashko, and N. M. Rudneva p 46–57 refs (See N67-20478 10-17)

N67-20475 Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

CERTAIN QUESTIONS OF ANALYSIS OF ISOLATED PHASES AND PHASE COMPOSITION OF ALLOYS

N. F. Lashko *In its* Phase Composition, Struct., and Properties of Alloy Steels and Alloys 30 Apr. 1966 p 1–21 refs (See N67-20474 10-17) CFSTI: $3.00

The distribution of alloying elements between phases in different alloys is investigated by the isolation of phases and their subsequent analysis by chemical, X-ray, and other methods. The electrolytic method of isolating phases from alloys is the most successful in many cases, and involves the selective dissolution of separate phases. The means of selecting the most optimum conditions for isolating both separate and groups of hererophase alloys can be outlined. It is shown that during the change of basic parameters of anode processes, current density and potential, every phase of an alloy passes through a number of active and passive states. Assuming that the independence of states of separate phases, determined by potential and current density, is justified at least in first approximation, the problem of electrochemical separation of phases will lead to the selection of electrolytes and conditions of electrolysis, ensuring creation of assigned active, inactive, passive, or underpassivations state in every phase. Some successes were obtained in studying anode processes in stainless steels, which were used for selective isolation of carbides, solid solutions, and alpha phases of steels, and during phase shift analysis of nickel alloys. R.N.A.

N67-20476# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

PHASE-SHIFT ANALYSIS OF ALLOYS OF TYPE EI437B WITH VARIABLE CARBON CONTENT

N. I. Blok, N. F. Lashko, and K. P. Sorokina *In its* Phase Composition, Struct., and Properties of Alloy Steels and Alloys 30 Apr. 1966 p 23–35 refs (See N67-20474 10-17) CFSTI: $3.00

In water electrolytes with sulfates of iron and ammonium from alloys of type EI437, α'-phase and titanium carbide are quantitatively isolated, and chromium carbides in alloys with raised content of carbon are partially dissolved. The chemical composition of α'-phase in alloys with low carbon content (<0.2%) is determined by applying double electrolytic dissolution of phases. The chemical composition of α'-phase in alloys with raised carbon content (>0.2%) is determined by a differentiated analysis of anode deposits separated in water electrolytes, while treating deposits in a mixture of hydrogen peroxide and hydrochloric acid, and in 20% sulfuric acid. In the solution with hydrogen peroxide carbides of chromium and α'-phase remain in insoluble deposit, and chromium carbides are dissolved. Chemical composition of α'-phase is calculated by difference. With carbon content 0.23% and more, rupture strength of alloys decreases and characteristics of plasticity are somewhat increased. This is basically caused by decrease of quantity of strengthening α'-phase as a result of binding of titanium and chromium into carbides TiC and $Me_{23}C_6$ and an increase of solubility of titanium and aluminum in solid solution. Author

N67-20477 Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

SURFACE OXIDATION AND PHASE CHANGE IN HEAT-RESISTING NICKEL ALLOYS IN LOADED STATE

N. I. Blok, N. F. Lashko, G. I. Morozova, and E. M. Radetskaya *In its* Phase Composition, Struct., and Properties of Alloy Steels and Alloys 30 Apr. 1966 p 37–46 refs (See N67-20474 10-17) CFSTI: $3.00

The effect of a loaded state on structural changes connected with diffusion processes in surface and internal layers of heat resisting nickel alloys EI437B, EI617, and EI929 was investigated. Results showed that alternating the load on alloy EI617 during fatigue testing does not affect the intensity of the oxidation process or the depletion of surface layers by alloy components as compared to the action of heating only. In alloy EI437B, heat treated and fatigue and stress-rupture tested at 800°C, and also in the alloy heat at 800°C without load, a recovery process occurs which causes partial dissolution of the alpha phase in the initial stage of aging. The recovery processes during aging flow less intensely during stress-rupture testing of the alloy than during fatigue testing and during its heating without load. In alloy EI617, the influence of the loaded state on phase changes is less than in ally EI437B. Aging of alloy EI617 at 900°C is accompanied by softening which occurs intensely during both fatigue testing and heating without load. Loading at 900°C has little effect on the phase composition of alloy EI929. R.N.A.

N67-20478 Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

PHASE COMPOSITION OF SURFACE LAYERS OF HEAT-RESISTING ALLOYS AFTER HEATING IN DIFFERENT MEDIA

M. N. Kozlova, N. F. Lashko, and N. M. Rudneva *In its* Phase Composition, Struct., and Properties of Alloy Steels and Alloys 30 Apr. 1966 p 46–57 refs (See N67-20474 10-17) CFSTI: $3.00

A phase shift and overall chemical composition analysis was made of surface layers of heat resistant nickel alloys after treatment in different gaseous environments containing nitrogen. Results show that annealing and heat treatment in nitrogen media, especially ammonia and ammonium chloride, causes an enrichment of the alloy's surface layer. This leads to a lowering of the alloy's mechanical characteristics. Heat treatment in these media is possible by removing the enriched surface layer. R.N.A.

N67-20598# Army Materials Research Agency, Watertown, Mass.

MECHANICAL PROPERTIES AND FRACTURE SURFACE TOPOGRAPHY OF A THERMALLY EMBRITTLED STEEL

Frank L. Carr, John Nunes, and Frank R. Larson Sep. 1966 36 p refs

(AMRA-TR-66-28; AD-643082) CFSTI: HC $3.00/MF $0.65

Tensile flow and fracture properties of 3140 steel in both the unembrittled and embrittled conditions are presented and discussed. Charpy impact properties which reflect the influence of thermal embrittlement on the transitional behavior are presented. Fracture surface topography is described. Quantitative data resulted in transitional curves for all three types of specimens utilized. This fracture surface topography also indicates that intergranular fracture has varying degrees of deformation, ductility, and energy required for separation. Several aspects of thermal embrittlement are discussed relative to the observations made in this study. Author (TAB)

N67-20601# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

THE EFFECT OF PRELIMINARY RECOVERY ON THE RECRYSTALLIZATION KINETICS OF DEFORMED METALS

L. N. Larikov, O. E. Zasimchuk, and Zh. Ya. Kutikhina 5 Oct. 1966 11 p refs Transl. into ENGLISH from Ukr. Fiz. Zh. (Kiev), v 10, no. 8, 1965 p 899–905

(FTD-HT-66-179; TT-67-60281; AD-643925) CFSTI: HC $3.00/MF $0.65

X-ray and microstructural methods were used to study the effect of preliminary annealing on subsequent recrystallization in single crystals of a number of pure metals (Cu, Ni, Nb, W, Mo). After weak deformations preliminary recovery of the samples leads to a delay and, sometimes, even to complete prevention of subsequent recrystallization. Single crystals of metals with body-centred lattices may be deformed by 30% and more without recrystallization during subsequent annealing, provided there is a definite geometry of plastic deformation. The effect of inhibition of recrystallization by preliminary annealing was observed earlier by Semell and Machlin on studying a weakly bent silver single crystal, and they connected it with the vanishing of excess vacancies during preliminary annealing. It is shown in this paper that in the investigated metals preliminary annealing inhibits subsequent recrystallization owing to polygonization rather than to vacancy rest. After strong (80%) deformations preliminary polygonization did not affect the subsequent course of recrystallization. Author (TAB)

N67-20638# Franklin Inst., Philadelphia, Pa. Research Labs.

THE MAGNETIC SUSCEPTIBILITY OF THE MERCURY-INDIUM LIQUID ALLOY SYSTEM Final Report

E. W. Collings Nov. 1966 32 p refs

(Contract Nonr-3644(00))

(F-B1900; AD-643147) CFSTI: HC $3.00/MF $0.65

The magnetic susceptibility at room temperature, and the temperature dependence of susceptibility of the mercury-indium liquid alloys system has been measured by the Curie method for In concentrations of up to about 60 atomic percent. Measurements were made at closely-spaced intervals of In concentration in the range 0 to 5 weight percent in which region an unexplained thermopower anomaly had been observed by previous workers. No corresponding susceptibility anomaly was observed. However, an examination of the deviation from linearity of chi (In) revealed special regions corresponding to Hg: In atomic ratios of 4:1 (12.5 weight percent In) and 1:1 (36 weight percent In) respectively. The susceptibility of Pure Hg at 20C, obtained by extrapolating the alloy data to zero In concentration was -0.1667 mir emu/gm. The temperature dependence of susceptibility of Pure Hg was not linear, but the temperature coefficient taken between 20C and 120C was 0.96 x 0.01 mir emu/gm-deg. Author (TAB)

N67-20655# Watervliet Arsenal, N. Y. Benet Labs.

EVALUATION OF ELECTRO DEPOSITED COPPER, LEAD, AND LEAD–TIN ALLOY (93–7%) BEARING SURFACES FOR SWAGING CANNON BORES

V. Peter Greco Apr. 1966 42 p refs

(WVT-6608; AD-637183) CFSTI: HC $3.00/MF $0.65

Electrodeposits of copper, lead, and lead–tin were evaluated as bearing surfaces for swaging steel cylinder bores. Drive pressure-time curves for the traveling mandrel are reviewed and discussed. The relationship between bearing surface characteristics of swaged cylinders and the behavior of the traveling mandrel were established. Metallographic and X-ray (back reflection Laue method) examinations are discussed and photographs are shown to exemplify bearing surface characteristics after swaging. Contrasting results are shown for the behavior of copper (exemplifying stick-slip motion) as compared to lead and lead–tin surfaces. Some results are also reported for tin and zinc electrodeposits. Average pressure-time curves from production runs are presented and compared with experimental lead and lead–tin tests. The evaluation has shown that lead is generally the best bearing material for the swaged tubes examined. Author (TAB)

N67-20660# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

MAGNETIC ALLOYS FOR HIGH TEMPERATURE SERVICE

G. V. Pshechenkova and A. D. Skokov 2 Sep. 1966 11 p refs Transl. into ENGLISH from Elektrichestvo (Moscow), no. 4, 1965 p 81–83

(FTD-HT-66-196; TT-67-60282; AD-643991) CFSTI: HC $3.00/MF $0.65

Curves were obtained of the magnetization of iron, iron–cobalt alloys, and alloy of the type permendur at temperatures up to 900C and also measurements were made of the mechanical properties of alloys at temperatures up to 800C. The alloys of iron with cobalt have a high index of induction at high temperatures. The data obtained can be used for computing magnetic systems which operate at high temperatures. Author (TAB)

N67-20685# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

EFFECT OF TITANIUM, ALUMINUM, CARBON, AND BORON ON THE STRUCTURE AND PHASE COMPOSITION OF A NICKEL-BASE ALLOY

G. S. Chernyak, A. V. Smirnova, et al 23 Sep. 1966 19 p refs Transl. into ENGLISH from Tsentr. Neuchn.-Issled. Inst. Chernoy Met., Sb. Tr. (Moscow), no. 38, 1964 p 51–65

(FTD-TT-65-1412; TT-67-60271; AD-643968) CFSTI: HC $3.00/MF $0.65

The use of complex methods of investigation, i.e., metallographic method involving stained film etching, electron microscopic, x-ray structural, electron-diffraction methods, etc., made it possible to establish the nature of the principal phases present in the batches studied, and also the influence of alloying elements, i.e., carbon, boron, titanium, and aluminum, on the structure and phase composition of the alloy. TAB

N67-20831# Babcock and Wilcox Co., Alliance, Ohio. Research Center.

MATERIALS EXAMINATION OF A MODEL SODIUM HEATED STEAM GENERATOR Final Report

D. W. Koch and P. J. Kovach 30 Jun. 1966 75 p refs

(Contract AT(11-1)-1280)

(BAW-1280-37; RR-5136) CFSTI: HC $3.00/MF $0.65

A test program was conducted to assess the compatibility of Croloy 2-1/4 and type 316 stainless steel in a liquid Na system. A single tube steam generator was designed to model 1000-Mw(e) steam generator design parameters, and samples were removed from the pipe after 1000 to 8000 hr operation at 600 to 1000°F (Croloy 2-1/4) and 800 to 1100°F (type 316 stainless steel). During exposure, the Croloy 2-1/4 surface partially decarburized to depths of 20–25 mils and was enriched in Ni, Cr, and O. The mass transfer from the type 316 stainless steel, confined within 8 microns of the surface, consisted of depletions of Ni and Cr and an enrichment in Fe. The stainless steel also carburized at the Na surface but was sensitized throughout. The mechanical property studies were inconclusive owing to the tempering effects of the exposure. The waterside corrosion behavior in the model was similar to that in conventional steam generators. It is concluded that Croloy 2-1/4 and type 316 stainless steel as construction materials are satisfactory. NSA

N67-20838# General Electric Co., Schenectady, N. Y. Knolls Atomic Power Lab.

TENSILE AND CREEP PROPERTIES OF NIOBIUM–VANADIUM ALLOYS AS INFLUENCED BY STRAIN RATE

C. D. Calhoun and F. W. Wiesinger 1 Jun. 1966 23 p refs
(Contract W-31-109-ENG-52)
(KAPL-3145) CFSTI: HC $3.00/MF $0.65

The strain-rate sensitivity of Nb-2 and Nb-6 wt % V was studied at 315 to 649°C. Notched tensile specimens were tested with cross-head speeds of 0.025 and 2.0 in./min. These alloys exhibited little variation in ductility or notch strength as a function of strain rate and/or temperature. These phenomena are explained by a strain-aging reaction which is operative in this temperature range. Creep tests were performed at 315 to 649°C. The specimens were step-loaded in tension for times of 200 to 1800 hr. Associated with each additional stress increment was either no deformation or fast deformation, which changed to either: (1) no further increase in strain, (2) a slow creep rate, or (3) continuation of deformation to failure. This behavior is also indicative of the strain-aging phenomenon found in this temperature range. Author (NSA)

N67-20849# Sandia Corp., Albuquerque, N. Mex.

SOLDERING TO GOLD PLATE

D. J. Sasmor, F. Greulich, H. Romero, and K. E. Mead Sep. 1966 30 p refs
(Contract AT(29-1)-789)
(SC-DR-66-469) CFSTI: HC $3.00/MF $0.65

The solution and reaction of Au in 60/40 (Sn/Pb) solder was studied utilizing metallographic techniques and the electron microprobe. The results show that the Au (plate) dissolves rapidly in the molten solder and forms an intermetallic compound identified as $AuSn_4$. The solder is degraded by the rejection of Pb. Studies of the mechanical strength of joints made with Au plate of various thicknesses on Cu show that the solder joint is materially weakened when the concentration of Au in the solder exceeds 3 to 5%. Author (NSA)

N67-20850# General Electric Co., San Jose, Calif. Advanced Products Operation.

SODIUM MASS TRANSFER. IX: THE EFFECT OF CARBON AND CARBONATE ADDITIONS IN A SODIUM TEST LOOP

R. W. Lockhart, comp. May 1966 48 p refs
(Contract AT(04-3)-189)
(GEAP-4436) CFSTI: HC $3.00/MF $0.65

The penetration of C into type 316 stainless steel exposed to circulating Na and associated impurities in the liquid metal and cover gas were measured. Carburized C steel was demonstrated to be an effective C source with system temperatures as low as 800°F. The addition of Na_2CO_3 to the Na produced elevated O_2 levels but the evidence of C transfer was negligible. C penetration rates were measured by machining thin layers of metal from cylindrical samples and analyzing the turnings for C. Reasonable diffusion rates in the steel at 800 to 1000°F were obtained. Author (NSA)

N67-20858# Oak Ridge National Lab., Tenn. Metals and Ceramics Div.

AN EXPLANATION OF THE ANOMALOUS HEAT CAPACITY OF URANIUM DICARBIDE

T. G. Godfrey and J. M. Leitnaker Oct. 1966 15 p refs Presented at the 21st Ann. Calorimetry Conf., Boulder, Colo., 22–24 Jun. 1966
(Contract W-7405-ENG-26)
(ORNL-TM-1595; CONF-660644-1) CFSTI: HC $3.00/MF $0.65

Published enthalpy data on UC_2 indicate a heat capacity of 32 cal $mole^{-1}$ deg^{+1} at 2000°K. Three lines of evidence indicate that the measurements are of acceptable accuracy. First, metallographic evidence indicates that a phase change takes place over a range of temperatures below approximately 2000°K. Second, high-temperature X-ray data indicate an unusual behavior in the lattice parameters of the UC_2 below 2000°K. Third, use of the enthalpy measurements with other published information completes a thermodynamic cycle in the U–C–O system. A non-zero $S^{0}_{0°K}$ is shown to be a reasonable assumption. Author (NSA)

N67-20860# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.

FABRICATION OF REFRACTORY COMPOSITES BY PNEUMATIC IMPACTION

R. K. Robinson and K. R. Sump 17 Jan. 1966 10 p Presented at the 11th Refractory Composites Working Group Meeting
(Contract AT(45-1)-1830)
(BNWL-SA-482) CFSTI: HC $3.00/MF $0.65

A process used to consolidate and shape ceramic powders and powdered cermets into high-density materials is described. Blended powders are heated to 3300°F in vacuo, transferred to high energy-rate forming machine, and impacted at pressures up to 400,000 psi. Semi-works production processes were developed for high-density complex shapes of ceramic dispersions in refractory metal matrices. NSA

N67-20863# Societe d'Etudes, de Recherches et d'Applications pour l'Industrie, Brussels (Belgium).

STUDIES OF STEEL CORROSION IN HIGH TEMPERATURE WATER AND STEAM Quarterly Report, 1 Apr.–30 Jun. 1966

25 Jul. 1966 79 p refs
(Contract EURATOM 087-66-1 TEEB (RD))
(EURAEC-1689; EUR-2876; QR-15) CFSTI: HC $3.00/MF $0.65

A study of the recrystallization conditions of various grades of milled stainless steels is discussed. The effects of heat-treatment time-length were investigated at 675°C. AISI 410, stainless steel is completely recrystallized after 1 hour at this temperature. Periods of up to 24 hr did not produce marked recrystallization in any of the austenitic grades examined. Long-duration tests in superheated steam at 500°C conducted on AISI 304 L steel confirmed previous conclusions. A work-hardening depth of 5 to 6 μm seems sufficient to guarantee good long-term behavior of this steel. Incoloy 800 and Inconel 600 were exposed for 1,000 hours to steam at 500 and 600°C. The weight results indicate that, in the milled state, Incoloy 800 behaves like AISI 304 steel and seems less sensitive to the rise in the temperature of the steam. Inconel 600 is less affected by the initial surface treatment than alloys containing less Ni. The extension of the tests on Zircaloy 2 confirms that the surface treatment has very little effect on the oxidation resistance of this alloy. The scatter in the results concerning the hydridation rate necessitates further determinations. Dynamic corrosion tests were conducted in water at 250 and 300°C, at 150 kg/cm^2, at a rate of 10 m/sec; the water was deliberately loaded with corrosion products by exposing a large surface area of AISI 410 stainless steel. Samples of AISI 304 stainless steel show increased corrosion in this medium over the level reached in pure water. 1.2 MD 07 boilerplate steel does not seem to be affected by this factor. The magnetic filtration tests which accompanied these experiments show that this system of filtration can be very effective at 300 and 320°C, whereas at 250°C it is inoperative. The colloidal particles of magnetite in suspension in the water coalesce under the effect of the magnetic field; the agglomerates formed in this way can be retained by an ordinary filter system. NSA

N67-20888# United Kingdom Atomic Energy Authority, Harwell (England).
WELDING TECHNIQUES FOR SMALL CAPSULES
F. T. Ewart and R. A. Carney Sep. 1966 6 p refs
(AERE-M-1801) HMSO: 2s 6d

A technique is described for producing high-integrity welds, in small closely defined areas on irradiation capsules. The method was originally developed for stainless steel; it has now been extended to include Mo alloys and W. Author (NSA)

N67-20890# Ohio State Univ. Research Foundation, Columbus.
A STUDY OF THE MECHANISM OF STRESS CORROSION CRACKING IN THE IRON–NICKEL–CHROMIUM ALLOY SYSTEM Quarterly Report, 17 Mar.–16 Jun. 1966
R. W. Staehle 30 Aug. 1966 56 p
(Contract AT(11-1)-1319)
(COO-1319-42) CFSTI: HC $3.00/MF $0.65

Stress corrosion cracking experiments are reported in dilute chloride environments at 500°F and in boiling $MgCl_2$ environments. Data are reported in terms of % unbroken vs time. Studies on effect of surface preparation are reported. Results of these studies show that various surface preparations greatly affect mean cracking times and can cause significant differences in data scatter. A study of the effect of alloy composition on annealing twin frequency was completed and final results show generally that increasing the Ni and Cr increases the frequency of annealing twins. Results are reported from a study of tensile properties as a function of temperature and alloy composition. A potentiokinetic polarization study was completed for the ternary Fe–Cr–Ni alloy system and results are summarized graphically. Figures presenting concepts in the theory of stress corrosion cracking are included. Author (NSA)

N67-20895# Bureau of Mines, Albany, Oreg. Metallurgy Research Center.
SELECT PROPERTIES OF THORIUM WITH LOW THORIA ADDITIONS Topical Report, 1 Jul. 1965–30 Jun. 1966
S. A. O'Hare and C. E. Armantrout Jul. 1966 18 p refs
(Contract AT(11-1)-599)
(USBM-RC-1245) CFSTI: HC $3.00/MF $0.65

Results of investigations are presented concerning submicron ThO_2 particles and their effect on hardness properties, tensile properties, and electrical resistivity of Th. Temperatures considered were ambient to 800°C for the hot hardness, 400 to 800°C for the tensile study, and 20°C for the electrical resistivity. Composition variation did not have any significant effect on the hardness or tensile properties but did affect the electrical resistivity. Increasing the ThO_2 content increased the electrical resistivity. Author (NSA)

N67-20929# General Electric Co., Pleasanton, Calif. Vallecitos Atomic Lab.
FRACTURE TOUGHNESS OF SOME ENGINEERING ALLOYS
M. B. Reynolds Mar. 1966 12 p refs
(Contract AT(04-3)-189)
(GEAP-5014) CFSTI: HC $3.00/MF $0.65

A summary is given of published fracture mechanics data for the following alloys: A302B steel for pressure vessels, turbine/generator rotor steels, Zircaloy-2, and Al alloys. The data tabulated include yield stress, fracture toughness, and critical stress intensity factor. The effects of temperature on fracture toughness are given. NSA

N67-20954# Atomic Energy of Canada, Ltd., Chalk River (Ontario).
THE EFFECT OF PREFERRED ORIENTATION OF THE MECHANICAL PROPERTIES AND DEFORMATION BEHAVIOUR OF ZIRCALOY-2 FUEL SHEATHING
K. P. Steward and B. A. Cheadle Aug. 1966 52 p refs
(AECL-2627) Available from Atomic Energy of Canada, Ltd., Chalk River: $1.50

Axial tensile, ring tensile, closed end burst, and free end burst tests were carried out at room temperature and 300°C on Zircaloy-2 sheathing covering a wide range of textures and percentages of residual cold work. Knoop hardness tests were also done on all batches. The mechanical properties of the tubes are largely dependent on the percentages of cold work, but are also affected by the textures, particularly with respect to deformation behavior. It is concluded that tubing with a single preferred orientation of radial basal poles shows the best combination of strength and ductility for any given degree of cold work. Author (NSA)

N67-20987# Institut de Recherches de la Siderurgie, Saint-Germain-en-Laye (France).
STUDY OF THE BASE METAL INTENDED FOR RESEARCH ON THE BRITTLE FRACTURE OF LARGE WELDMENTS Quarterly Report, 1 Apr.–30 Jul. 1966
Aug. 1966 7 p refs
(Contract EURATOM-031-64-5-TEEF (RD))
(QR-9; EURAEC-1700; EUR-2887) CFSTI: HC $3.00/MF $0.65

Results of studies concerning fast transformations in specimens of AMMO steel during separate tests of fast heating to 900°, 1000°, 1100°, and 1250°C with immediate cooling after each heat application. Resulting data obtained by magnetic and thermal analyses are presented as transformation curves. NSA

N67-21005# General Dynamics Corp., San Diego, Calif. John Jay Hopkins Lab. for Pure and Applied Science.
A PROGRAM OF BASIC RESEARCH ON MECHANICAL PROPERTIES OF REACTOR MATERIALS Quarterly Progress Report, 1 Feb.–30 Apr. 1966
T. A. Trozera and R. H. Chambers 27 Jun. 1966 19 p refs
(Contract AT(04-3)-167)
(GA-7233) CFSTI: HC $3.00/MF $0.65

Development of methods for evaluating neutron-induced changes in bcc metals is discussed. A major method selected is based on resistivity measurements using the value of the ratio of resistance at room temperature to that at 4.2°K. Sample resistance variations due to raw materials and zone refining parameters are discussed. Research is reported on the forces resisting the motion of dislocation segments such as edge, screw, geometrical kinks, and jogs. Data are included on damping spectra of high-purity Ta crystals and dislocation strain as function of temperature for deformed specimens of Nb, Fe, Ta, and W. Data are also included on transition metal dislocation activation energies and flaw stress vs temperature in these metals. NSA

N67-21009# Rocky Flats Div., Dow Chemical Co., Golden, Colo.
TRANSMISSION ELECTRON MICROSCOPY OF Pu–1 w/o Ga
A. W. Brewer and F. J. Fraikor [1966] 7 p refs Presented at the Microsymp. on Electron Microscopy, Walnut Creek, Calif.
(Contract AT(29-1)-1106)
(RFP-807; CONF-660809-1) CFSTI: HC $3.00/MF $0.65

An investigation of dislocations in Ga–Pu alloys is described. Rapid dislocation rearrangement and sub-boundary movement occurred upon exposure to the electron beam. After this initial movement, no further effect of thermal stresses was observed. It is concluded that transmission photomicrographs obtained in the investigation reveal a microstructure which is probably not indicative of that resulting from heat treating bulk Pu; however, they are a basis for further work. NSA

N67-21055# European Atomic Energy Community, Brussels (Belgium).
INFLUENCE OF SURFACE TREATMENT ON VARIOUS TYPES OF STAINLESS STEELS CORROSION
J.-Ph. Berge Dec. 1966 16 p refs Presented at the 3d Intern. Congr. on Metallic Corrosion, Moscow, 16–25 May 1966
(EUR-2891.e: EURAEC-1709) CFSTI: HC $3.00/MF $0.65

The effects of the chemical, physical, microgeometric (roughness) surface state characteristics on various types of corrosion in stainless steels are discussed. Anodic passivation, stress corrosion, intergranular corrosion, and corrosion in steam at high temperature are discussed. Methods used to determine the surface state characteristics are described. The examples given show that in general a surface state cannot be adequately determined by the roughness value alone. L.S.

N67-21058# Southampton Univ. (England). Inst. of Sound and Vibration Research.
SIGNIFICANCE OF THE DISCONTINUITY IN S/N FATIGUE CURVES
T. R. G. Williams and P. J. Mitchell Jan. 1965 20 p refs
(Contract AF 61(052)-504)
(ISAV-MEMO-118; AD-640838) CFSTI: HC $3.00/MF $0.65

The significance of the discontinuity in the S/N fatigue curve has been assessed by comparative testing under constant load and constant strain conditions. Reinforcement of the surface grain of a mild steel and a stainless steel have produced a large improvement in fatigue strength, the fatigue limit coinciding with the discontinuity. Author (TAB)

N67-21066# Kernforschungsanlage, Juelich (West Germany). Institut fuer Reaktorwerkstoffe.
MEASUREMENT OF ELECTRICAL RESISTANCE AT 4.2°K IN SEVERAL CORRUPTIBLE PURE METALS (Al, Ag, Au, Cu AND Fe) AS A METHOD OF TESTING PURITY [MESSUNGEN DES ELEKTRISCHEN WIDERSTANDES BEI 4,2°K VON EINIGEN KAEUFLICHEN REINSTMETALLEN (Al, Ag, Au, Cu UND Fe) ALS EINE METHODE DER REINHEITSPRUEFUNG]
F. Dworschak and J. Wurm Nov. 1965 18 p refs In GERMAN
(JUL-317-RW) CFSTI: HC $3.00/MF $0.65

Electrical resistivity measurements at 4.2°K on pure metals gave only qualitative information of impurities. This relative simple, fast, and nondestructive test method for purity control was especially recommended for the study of lattice defects. However, it was not possible to establish a correlation between the residual resistance and the actual impurity degree determined. Residual resistance values were found for Al, Ag, Au, Cu, and Fe and are presented in table form. Transl. by G.G.

N67-21154# Los Alamos Scientific Lab., N. Mex.
AN EQUATION OF STATE FOR IRON ASSUMING AN INSTANTANEOUS PHASE CHANGE
Charles L. Mader 2 Dec. 1966 20 p refs
(Contract W-7405-ENG-36)
(LA-3599) CFSTI: HC $3.00/MF $0.65

Iron undergoes a phase transition at 130 kbar, producing two compressive shocks. This transition can be numerically described in one-dimensional hydrodynamic calculations by using a Grüneisen equation of state to calculate the state points off the Hugoniot. The Hugoniot is described by $U_s = 0.463 + 1.275\ U_p$ (where U_s is shock velocity and U_p is particle velocity in cm/μsec) from normal specific volume to 0.1190 cc/gm; the Hugoniot pressure is maintained at 130 kbar between 0.1190 and 0.1148 cc/gm; and between 130 and 440 kbar the Hugoniot is described by $U_s = 0.32 + 2.25\ U_p$. This treatment of the Hugoniot of iron assumes that the phase change occurs instantaneously. Author (NSA)

N67-21157 Societa Ricerche Impianti Nucleari, Saluggia (Italy).
ON THE EFFECT OF NITROGEN ON THE MECHANICAL PROPERTIES OF NEUTRON IRRADIATED PURE IRON
A. Ferro (Ist. Elettrotecnico Nazl. "G. Ferraris"), J. Sebille (EURATOM), M. Castagna, and F. S. Rossi Brussels, EURATOM, Dec. 1966 34 p refs Presented at Symp. on the Effects of Radiation on Structural Metals, Atlantic City, 29 Jun.–1 Jul. 1966
(Contract EURATOM-004-63-10 TEEI)
(EUR-2393.e; EURAEC-1472) CFSTI: $3.00

The changes in mechanical properties of pure Armco iron remelted in vacuo and with the last traces of interstitials completely blocked by suitable titanium addition were determined on specimens of different grain sizes. This material shows an extremely low value of k_y in the Petch equation; the value of δ_o in the Petch equation increases linearly with the titanium concentration. After irradiation up to 1.4×10^{19} nvt (>1 MeV) at a temperature below 55°C, this material shows somewhat anomalous Petch lines, with higher values of k_y in the coarse grain range and a low value in the fine grain size region. The transition temperature for resilience (subsize V-notch specimens) increases, after irradiation from about −60°C to about +10°C. For Armco iron remelted in vacuo and deoxidized with silicon or aluminum, in which a rather large concentration of nitrogen (0.02 weight %) was introduced, the value of k_y is strongly reduced by irradiation. No anomalous behavior in the Petch is observed in both materials. The transition temperature increases from about +20°C to about +180°C for silicon-killed specimens, and increases only from about −50°C to about +17°C, for aluminum-killed specimens. Author

N67-21247# Israel Program for Scientific Translations, Ltd., Jerusalem.
CURRENT STATE AND TRENDS IN THE USE OF RADIOISOTOPES AND NUCLEAR RADIATIONS IN METALLURGY AND MINING
P. L. Gruzin, Yu. F. Babikova, G. S. Gerasimchuk, A. K. Lebedev, G. S. Rozhavskii et al. *In its* The Uses of Radioact. Isotopes and Nucl. Radiation in the U.S.S.R. Vol. III: Machine Bldg., Met. 1966 p 111–120 (See N67-21221 10-15) CFSTI: HC $3.00/MF $0.65

Methods employed, equipment available, and results obtained by the use of radioisotopes and nuclear radiation methods in metallurgy and mining operations are reviewed. Research trends that are regarded as promising include: (1) determination of characteristics of steel-smelting furnaces to accelerate the smelting process, (2) control of metal deformation, (3) development of specific radiometric and activation methods for impurity detection, (4) distribution of elements during diffusion and other processes, (5) visual methods for gamma flaw detection, (6) development of radiometric transducers, and (7) metallurgical studies at various temperature and pressure conditions to improve processing and production of metal products. M.W.R.

N67-21430# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE PRODUCTION OF SOFT-MAGNETIC MATERIALS BY THE METHOD OF POWDER METALLURGY
N. I. Litovchenko, G. G. Dobrovol'skiy, V. I. Uvarov, V. S. Vas'kovskiy, and G. V. Viktorov 29 Jul. 1966 9 p Transl. into ENGLISH from Mashinostroenie (Kiev), no. 4, 1964 p 68–69
(FTD-HT-66-320; AD-644048) CFSTI: HC $3.00/MF $0.65

Electrical technology uses a large number of parts made from low-carbon chemically pure armko-steel. Such parts are generally called magnetically soft. They operate in a constant, pulsed or variable magnetic field, because of which they require a low coercive force (0.9 - 1.5 Oe), a magnetic induction within the range of 14000 - 15000 Gs and a magnetic permeability of 3.5 - 5.5 thousand Gs/O3. Conversion to the production of soft magnetic

material by the method of powder metallurgy permits the saving of a large quantity of electrotechnical steel, the reduction of labor in fabrication, mechanization and automation of production processes while maintaining the required magnetic properties. TAB

N67-21455*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
RECRYSTALLIZATION AND PREFERRED ORIENTATION IN SINGLE-CRYSTAL AND POLYCRYSTALLINE COPPER IN FRICTION STUDIES
Donald H. Buckley Washington, NASA, Mar. 1967 13 p refs
(NASA-TN-D-3794) CFSTI: HC$3.00/MF$0.65 CSCL 11F

From the results of an investigation with single-crystal and polycrystalline copper sliding on aluminum in vacuum (10^{-11}torr) the following summation is made: Although differences in friction coefficients exist for single-crystal and polycrystalline copper at light loads, a nearly common friction coefficient is obtained for the two forms of copper at higher loads. This effect is due to surface recrystallization and preferred orientation of copper at the sliding interface. X-ray data indicate the surface recrystallized layers to be the same at a 1000-gram load. Author

N67-21495# California Univ., Berkeley. Lawrence Radiation Lab.
ANNEALING OF DISLOCATION LOOPS IN ALUMINUM
Jean-Pierre Tartour (M.S. Thesis) Aug. 1966 47 p refs
(Contract W-7405-ENG-48)
(UCRL-16907) CFSTI: HC$3.00/MF$0.65

The change in shape after annealing of Frank loops in quenched 99.999% pure Al was studied by electron microscopy. The loops are found to get roundish at the corners. The process continues until the loops become perfectly round, then they shrink as such upon further annealing. The activation energy for the rounding process is found to be 0.8 eV±0.2 eV, suggesting that some short circuit diffusion takes place. A model is proposed according to which the process should be controlled by the creation of bound vacancies at the preexisting well-formed jogs. Author (NSA)

N67-21501# Atomic Energy of Canada, Ltd., Chalk River (Ontario).
THE EFFECT OF HYDROGEN ON THE FRACTURE TOUGHNESS OF ZIRCALOY-2 AND ZIRCONIUM-2.5% NIOBIUM
G. W. Parry Aug. 1966 23 p refs
(AECL-2622) Available from Atomic Energy of Canada, Ltd., Chalk River: $1.00

The effect of hydrogen on the plane strain fracture toughness of single edge notch specimens from Zircaloy-2 and Zr-2.5% Nb pressure tubes was determined by crack opening displacement measurements and by application of linear elastic fracture mechanics. It is shown that hydrogen lowers the room temperature fracture toughness and critical crack lengths of the materials, whereas at 300°C Zircaloy-2 is unaffected by H_2 concentrations up to 500 ppm. Hydride layers at the notch tip greatly reduce the room temperature fracture toughness of Zircaloy-2. The critical crack opening displacement approach does not obey the stress vs. $\delta_{1/2}$ theoretical straight line relationship at H_2 concentrations below 400 ppm, while gross yielding at the notch tip makes the linear elastic treatment invalid below 500 ppm H_2. It was concluded that the single edge notch specimen is suitable for fracture toughness measurements of Zircaloy-2 and Zr-2.5% Nb within these limitations. Author (NSA)

N67-21503# India. Dept. of Atomic Energy, Bombay.
ANNEALING BEHAVIOR OF LOW TEMPERATURE NEUTRON-IRRADIATED TRIS-ACDTYLACETONE (III) IN ELECTRON-ACCEPTING (OXYGEN) AND INERT (NITROGEN) AMBIENTS
S. Sarup and Amar Nath 1966 23 p refs
(AEET-256)

A detailed comparative study of the kinetics of annealing of neutron-irradiated 2,4-pentanedione cobalt(III) in the presence of oxygen (air) and in its absence (in nitrogen) was carried out. The characteristic features of the annealing behavior were interpreted on the basis of the variable depth electron donors–exchange model. Author (NSA)

N67-21504# India. Dept. of Atomic Energy, Bombay.
COMPATIBILITY STUDIES ON ZIRCONIUM ALLOYS IN SANTOWAX-OM AT 750°F
Sohan Singh, J. B. Gnanamoorthy, and J. Balachandra 1966 14 p refs
(AEET-260)

The following alloys were tested in the α-annealed state: Kroll zirconium, Zr–1% Cu–1% Fe, Zr–1% Cr, Zr–2% Cr, Zr–2% Fe, and Zr–2% Cu. The testing was carried out under static conditions in Santowax OM containing 30 to 100 ppM H_2O for 10 to 90 days. Weight gains and hydridations were measured, and the surface effects were determined metallographically. The alloys showing the best compatibility were Kroll Zr and the alloys containing Cr. The similarity of the corrosion in Santowax OM to that in steam suggests that the moisture plays an important role. NSA

N67-21506# Atomic Weapons Research Estsblishment, Aldermaston (England).
X-RAY EXAMINATION OF TITANIUM HYDRIDE
P. M. S. Jones, P. Ellis, J. R. Smith, T. Aslett, and C. G. Hutcheson Aug. 1966 12 p refs
(AWRE-O-60/66) HMSO: 2s

Results are given of X-ray examination of Ti–H alloys by both the Debye–Scherer and diffractometer methods. It is found that the hydrogen-deficient hydride phase appears when the atomic ratio H/Ti falls to 1.37±0.03. Author (NSA)

N67-21522# MSA Research Corp., Evans City, Pa.
DEVELOPMENT OF TECHNIQUES FOR MEASUREMENT OF IMPURITIES IN SODIUM
R. C. Andrews, K. R. Barker, and R. C. Werner 9 Nov. 1966 24 p refs
(Contract AT(11-1)-765)
(MSAR-66-221) CFSTI: HC$3.00/MF$0.65

Results are reported for studies on the development of equipment and methods for determination of impurities (including H, C, and O) in sodium. The methods discussed include: surface tension; solvent extraction; mass spectrometry; carburization; electrical potential concentration; electrical sensing; and continuous hydrogen monitoring. NSA

N67-21528# General Dynamics Corp., San Diego, Calif. John Jay Hopkins Lab. for Pure and Applied Physics.
A RESEARCH PROGRAM ON THE EFFECT OF SUBSTRUCTURE ON THE IRRADIATION STABILITY OF ASTM A302 GRADE B STEEL Quarterly Progress Report
T. A. Trozera and P. W. Flynn 14 Jul. 1966 8 p
(Contract AT(04-3)-617)
(GA-7282; QPR-5; EURAEC-1696) CFSTI: HC$3.00/MF$0.65

Electron microscope examination of cold-worked and heat-treated A302-B steel reveals a dislocation network about 1/25 of the as-received grain size. Test material has been cold worked and heat treated. The first irradiation capsule is in final stages of assembly. Author (NSA)

N67-21534# IIT Research Inst., Chicago, Ill. Technology Center.
RESEARCH ON ZIRCALOY BRAZE ALLOY DEVELOPMENT Quarterly Report, 1 Jul.–30 Sep. 1966
17 Oct. 1966 12 p
(Contract AT(11-1)-578)
(IITRI-578P29-5; EURAEC-1737)

The first series of candidate braze alloys was prepared for evaluation. Twenty-two Zr-base binary alloy systems, including fifty-seven compositions, will be subjected to a superheated water environment in the as-cast and brazed conditions. More advanced Zr-base alloys will generate from those compositions exhibiting superior corrosion and hydrogen-uptake resistance. Author (NSA)

N67-21567# Combustion Engineering, Inc., Windsor, Conn. Nuclear Div.
CORRELATIONS BETWEEN SENSITIZATION AND STRESS CORROSION CRACKING OF 300 SERIES STAINLESS STEELS Final Summary Report
J. J. Koziol and S. S. Christopher Sep. 1966 82 p refs
(Contract AT(30-1)-3256)
(CEND-3256-264; EURAEC-1568) CFSTI: HC$3.00/MF$0.65

The effects of preoxidation and variations in surface conditions on the susceptibility to transgranular cracking of Types 304 and 347 stainless steel were studied. Tubing with annealed, drawn, swaged, and diffused Ni surfaces was exposed to an aqueous environment to evaluate the differences in behavior of nonstabilized and stabilized types (304 and 347) of stainless steels under identical test conditions. Tubes with swaged surfaces (15% R.A.) and surfaces containing diffused Ni layers showed improved resistance to transgranular cracking when compared with the other samples evaluated in this program. A trend toward increased susceptibility to transgranular cracking, which was observed for preoxidized and sensitized Type 304 stainless steel confirmed the possibility of interaction between grain boundary oxidation and transgranular cracking. Author (NSA)

N67-21568# Denver Research Inst., Colo.
STUDIES OF THE EFFECT OF INTERSTITIAL ADDITION ON THE PHASE EQUILIBRIA OF THE NIOBIUM-RICH REGION OF THE NIOBIUM–TUNGSTEN–HAFNIUM AND NIOBIUM–TUNGSTEN–ZIRCONIUM ALLOY SYSTEMS Quarterly Progress Report
Albert S. Yamamoto Sep. 1966 9 p refs
(Contract AT(11-1)-1092)
(DRI-1092-235; DRI-2353; QPR-8) CFSTI: HC$3.00/MF$0.65

The effect of small carbon and oxygen additions on the phase equilibria of the niobium-rich region of the niobium–tungsten–hafnium and niobium–tungsten–zirconium alloy systems is under investigation. The features of the niobium-rich isotherms, although not final as yet, are observed as follows: (1) Nb–W–Hf alloys with carbon additions: HfC is at least the principal second phase besides perhaps another precipitate beyond the phase boundary of the Nb-rich Nb–W–Hf solid solution with carbon addition in the range of 0.05 to 0.5 wt %. The solid solution phase fields at both 1600 and 1300°C are much more restricted as a result of carbide precipitation than that determined at 1300°C for similar alloys without intentional carbon additions. (2) Nb–W–Hf alloys with oxygen additions: The region of Nb-rich solid solution is limited by addition of oxygen. Oxygen seems to be more effective in restricting the solid solution than carbon is. In the compositional range investigated, HfO_2 is the precipitated phase in most of alloys containing more than 5 wt % Hf. Other phases appeared to exist in alloys with 15 wt % each and 25 wt % each of tungsten and hafnium and 0.1 wt % O is W_2Hf. (3) Nb–W–Zr alloys with carbon additions: Carbon additions (from 0.01 to 0.25 wt %) to the Nb–W–Zr alloys resulted in the formation of ZrC at both 1600 and 1300°C as a primary precipitate in the Nb-rich solid solution whose solubility range was subsequently reduced further than the comparable solid solution without carbon. Another effect of carbon observed is that it stabilizes α–Zr at these two temperatures as oxygen does to the similar alloys. Existence of W_2Zr is determined in alloys containing 25 wt % each of tungsten and zirconium and 0.01 to 0.25 wt % C. (4) Nb–W–Zr alloys with oxygen additions: No tentative solubility range of the Nb-rich solid solution is established as yet although it is anticipated to be very limited. Like carbon, oxygen when added to these alloys (in the range of 0.01 to 0.1 wt %) produces α–Zr which is stable at both 1600 and 1300°C. In addition to α–Zr, W_2Zr is found to be present in Nb–25 wt % W–25 wt % Zr alloys with 0.01 to 0.1 wt % C. Author (NSA)

N67-21573# Arizona Univ., Tucson. Dept. of Physics.
HIGH TEMPERATURE ANNEALS OF DEFECTS QUENCHED IN METALS Technical Progress Report
Roy M. Emrick Nov. 1966 25 p refs
(Contract AT(11-1)-1456)
(COO-1456-3) CFSTI: HC$3.00/MF$0.65

A circuit was developed for accurate pulsing of high-temperature anneals, and eight runs were made on gold wires. The effective vacancy motional energy as determined from the preliminary results was found to be comparable with values obtained by conventional methods. Possible reasons for this result are discussed. Measurements of the pressure effect in the annealing of quenched-in resistance in aluminum are reported briefly. NSA

N67-21575# Brookhaven National Lab., Upton, N. Y.
THE BEHAVIOR OF REFRACTORY METALS AND ALLOYS IN BOILING SODIUM AND OTHER ALKALI METALS
A. Romano, A. Fleitman, and C. Klamut [1966] 19 p refs
Presented at the Intern. Atomic Energy Agency Symp. on Alkali Metal Coolants, Corrosion Studies, and System Operating Experience, Vienna
(Contract AT(30-2)-GEN-16)
(BNL-10723; CONF-661110-2) CFSTI: HC$3.00/MF$0.65

A study was undertaken to determine whether Na or Cs (boiling and liquid) can be contained in refractory metal alloys. Other alkali metals were also tested in these alloys to compare their corrosiveness with that of Na and Cs. Of all the refractory metal alloys tested, alloy FS-85 (Nb–27Ta–10W–1Zr) was the most susceptible to corrosion by Na; intergranular penetration as deep as 0.05 mm was detected in one test. Several other alloys exhibited very slight tranagranular corrosion by Na, but most of the alloys were not attacked. None of the alloys seem to be susceptible to stress-induced corrosion. The compatibility of two alloys (Nb–1Zr and Nb–10W–1Zr) with Li, Na, K, Rb, and Cs was also evaluated. In general, very slight corrosion was detected in these tests; although K seemed to be the least aggressive of the alkali metals in Nb–1Zr, there was no corrosion of Nb–10W–1Zr detected. Of all the alkali metals, Cs offers the most attractive thermodynamic properties relative to optimum turbine design. The alloys TZM and TZC were tested under conditions of high velocity vapor impingement (245 m/sec) at 840°C for 1096 hr in a forced circulation loop fabricated completely of refractory metals. Results of this test showed no corrosion or erosion of either of the test materials but a 0.025 mm-thick deposit of Nb was found on each blade. Author (NSA)

N67-21615# United Kingdom Atomic Energy Authority, Harwell (England). Information Branch.
COMPENDIUM OF REFERENCES TO STUDIES OF THE PROPERTIES OF LIQUID METAL BINARY SYSTEMS WHICH RELATE TO THEIR STRUCTURE

B. W. Mott, M. E. Downey, and P. A. Cumming Sep. 1966 58 p refs
(AERE-BIB-151) HMSO: 8s

The references are compiled in alphabetical order of chemical symbol for the components of each system. Papers dealing solely with experimental work on thermodynamic properties were omitted as these are available elsewhere. NSA

N67-21617# Illinois Univ., Urbana. Dept. of Mining, Metallurgy, and Petroleum Engineering.
FREQUENCY DEPENDENCE OF DISLOCATION DAMPING IN SINGLE CRYSTAL COPPER
Clinton Rie Heiple 1967 72 p refs
(Contract AT(11-1)-1198)
(COO-1198-401) CFSTI: HC $3.00/MF $0.65

The frequency dependence of the amplitude-dependent and amplitude-independent dislocation damping was measured on the same high-purity Cu single crystal in both the kilocycle and megacycle frequency ranges. The dislocation contribution to the elastic modulus was also measured in the kilocycle range. The results are discussed in terms of a theoretical calculation that treats the dislocation as a pinned elastic string that experiences a viscous drag proportional to its velocity. The kilocycle dislocation damping exhibited an approximately linear frequency made with a relation of the form $\Delta = \alpha\omega^{-1} + \beta\omega$ It is proposed that the term $\alpha\omega^{-1}$ is a contribution from the high-frequency side of a low-frequency maximum. The dislocation damping in the megacycle range was proportional to ω^{-1}. The kilocycle and megacycle data are consistent with a curve of the form $\Delta = K\omega\tau/(1+\omega^2\tau^2)$ as predicted by the string model. The maximum is at 1.7 Mc. The dislocation density is calculated to be 2.3 ± 10^6 cm^{-2} and the average loop length to be 5.1 ± 10^{-4} cm, assuming an exponential loop length distribution. The modulus defect was found to be independent of frequency except for a small rise with decreasing frequency below 30 kc. The amplitude-dependent internal friction of the specimen in the kilocycle range was found to be frequency-dependent in the annealed state and to be frequency-independent in the neutron-irradiated state. The strain amplitude above which the specimen exhibited amplitude dependence was observed to increase with frequency in the kilocycle range. Author (NSA)

N67-21654# General Dynamics Corp., San Diego, Calif. John Jay Hopkins Lab. of Pure and Applied Science.
PROGRAM OF BASIC RESEARCH ON MECHANICAL PROPERTIES OF REACTOR MATERIALS Quarterly Progress Report, 1 May–31 Jul. 1966
T. A. Trozera 17 Oct. 1966 8 p refs
(Contract AT(04-3)-167)
(GA-7436) CFSTI: HC $3.00/MF $0.65

The effects of neutron damage in a high-purity bcc metal were studied by means of liquid-helium-temperature resistance measurements, mechanical-property measurements, and stored-energy measurements. NSA

N67-21675# Rutgers Univ., New Brunswick, N. J. Bureau of Engineering Research.
MECHANISM OF EROSION OF SOLID METALS Progress Report
Mark B. Moore Jun. 1966 10 p ref
(Contract AT(30-1)-3477)
(NYO-3477-8) CFSTI: HC $3.00/MF $0.65

Three separate modes or phases of erosion have been identified, and tests have been made involving each of the phases. The rate of Phase A erosion has been identified with the energy of the eroding particles, and tests to date indicate that, at constant particle energy levels, variation in the particle momentum has no appreciable effect upon the rate of Phase A erosion. Tests are in progress to attempt to determine if similar relationships exist between particle energy, particle momentum, and the rates of Phase B erosion. Stepwise erosion has been identified as a metal flow phenomenon, involving simultaneous Phase A and Phase B types of action. The existence of stepwise erosion has been found to be dependent upon original contact angle, particle velocity, particle size, and possibly upon solids-to-air loading ratio. The projected study of single-particle trajectories has not yet yielded satisfactory results, due to poor performance of the single-particle gun. Redesign of the gun is now under way. Author (NSA)

N67-21685# General Electric Co., San Jose, Calif. Atomic Power Equipment Dept.
SPECIFIC ZIRCONIUM ALLOY DESIGN PROGRAM
7 Oct. 1966 8 p refs
(Contract AT(04-3)-189)
(EURAEC-1738; QR-14) CFSTI: HC $3.00/MF $0.65

A Zr+2.0 at. % Cr+0.16 at. % Fe alloy is being evaluated as water reactor fuel cladding. Three different laboratory melts have been fabricated to sheet by porcesses established from the physical metallurgy studies and statistically designed fabrication experiments. The corrosion rates of the laboratory material were established by corrosion exposures in refreshed oxygenated steam. A full-scale tubing fabrication process has been established. The second tubing batch processing is complete through extrusion and the first two tube reductions are complete on one-half of the order. Rod for fuel end caps has been received. NSA

N67-21699# Stanford Univ., Calif. Dept. of Materials Science.
INFLUENCE OF HYDROGEN ON THE MECHANICAL PROPERTIES OF CHARPY V-NOTCH SPECIMENS OF LOW CARBON STEEL
Arnaud P. Fayet (M.S. Thesis) Sep. 1966 54 p refs
(Contract DA-31-124-ARO(D)-251)
(SU-DMS-66-8; AROD-4800-4; TR-4; AD-643944) CFSTI: HC $3.00/MF $0.65

Hydrogen embrittlement has been studied in steels containing 0.16% and 0.006% carbon which were subjected to an electrolytical charging. Charpy V - notch specimens of these materials were tested in three point slow bend loading. No embrittling effect of hydrogen appears below the ductility transition temperature of either alloy. Above this temperature, hydrogen embrittlement results from the formation of a high density of voids and the sharpening of the notch tip by coalescence with these voids. In contrast to the case of Iron -3% silicon, there is no evidence of hydrogen induced cleavage cracks. Author (TAB)

N67-21733# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
EFFECT OF A COPPER ADMIXTURE ON ELECTRICAL PROPERTIES OF InSb
A. D. Berkeliyev, V. V. Galavanov and D. N. Nasledov 8 Dec. 1966 8 p refs Transl. into ENGLISH from Izv. Akad Nauk Turkmsr. Ser. Fiziko-Tekhn., Khim. i Geol. Nauk (Ashkhabad), no. 4, 1965 p 105–107
(FTD-HT-66-538; TT-67-60208; AD-643640) CFSTI: HC $3.00/MF $0.65

Some results of electrical properties of p-InSb crystals, obtained by the diffusion of copper into n-type crystals, are given. A table is given of concentration values N and mobility U of

current carrying samples at 78K before and after diffusion annealing. It is shown on the table that samples with electron concentrations of 2--4.10 to the 13th power/cu cm change the type of conductivity at a temperature of 260C, and in samples with electron concentrations of 8.10 to the 13th power/cu cm the change in conductivity type takes place at a temperature of 300C. It is pointed out that investigations have shown that annealing of samples in a vacuum and in an argon atmosphere gives the same result. Samples of p-type with a low concentration of holes and sufficiently high mobility can be obtained by the diffusion of copper into n-InSb. Author (TAB)

N67-21738# Marine Engineering Lab., Annapolis, Md.
EFFECTS OF NOTCHES AND SALTWATER CORROSION ON THE FLEXURAL FATIGUE PROPERTIES OF STEELS FOR HYDROSPACE VEHICLES
M. R. Gross and E. J. Czyryca Oct. 1966 42 p refs
(MEL-420/66; AD-644147) CFSTI: HC $3.00/MF $0.65

The flexural fatigue behavior of five constructional steels was investigated in air and salt water over a broad life spectrum ranging from 1000 to 100 million cycles. The yield strengths of the steels ranged from 40 to 200 thousand pounds per square inch (ksi). The effects of notches having theoretical stress concentrations ranging from 1.3 to 6 were included in this study. General conclusions are: (1) both mechanical notches and saltwater corrosion are more damaging in high-cycle fatigue; (2) the combined effect of mechanical notches and salt water is greater than either operating independently; and (3) the high-cycle saltwater corrosion-fatigue strengths of sharply notched low and intermediate alloy steels are less than 10 ksi beyond 10-million cycles, regardless of the tensile yield strength level. Additional conclusions relative to notch root radius, corrosion characteristics of the steels, and fatigue design curves are presented. TAB

N67-21776# Atomic Energy Commission Research Establishment, Riso (Denmark). Metallurgy Div.
HIGH TEMPERATURE STABILITY OF SINTERED ALUMINUM PRODUCTS EXAMINED BY DENSITY MEASUREMENTS
Niels Hansen and Keith W. Jones Mar. 1963 19 p refs
(RISO-58) CFSTI: HC $3.00/MF $0.65

Heat treatment in air at 600°C of sintered aluminum products with a high gas content results in formation of fissures accompanied by a simultaneous decrease in density. The total volume of fissures formed decreases with increasing high temperature strength of the material for equal gas contents. A degassing treatment in vacuum at 600°C reduces the density slightly without changing the microstructure of the products. This decrease is proportional to the product's oxide content. A large densification has been obtained in some of the materials by hot compaction at 550°C after the vacuum degassing. Sintered aluminum materials heat treated and hot compacted to maximum densities show a straight line relationship between the density and oxide content. The density of the oxide phase in these materials has been calculated to 3.37 g/cm^3. Author (ESRO)

N67-21786# MSA Research Corp., Evans City, Pa.
EFFECT OF HIGH TEMPERATURE SODIUM ON AUSTENITIC AND FERRITIC STEELS. MECHANICAL PROPERTIES OF MATERIALS Quarterly Progress Report, Jul.--Sep. 1966
R. C. Andrews and K. R. Barker Oct. 1966 30 p
(Contract AT(11-1)-765)
(MSAR-66-220) CFSTI: HC $3.00/MF $0.65

The status of Tests 6 and 7 (304 stainless steel in 1200°F sodium contaminated with oxygen or carbon) is discussed. The testing of LVDT's for the liquid-metal extensometer system showed failure above 800°F due to electrical breakdown in the insulators. Data are presented for the analyses of the cold traps from Tests 3 and 5. NSA

N67-21801# General Dynamics Corp., San Diego, Calif. General Atomic Div.
A RESEARCH PROGRAM ON THE EFFECT OF SUBSTRUCTURE ON THE IRRADIATION STABILITY OF ASTM A302 GRADE B STEEL Quarterly Progress Report
T. A. Trozera and P. W. Flynn 12 Apr. 1966 15 p ref
(Contract AT(40-3)-167)
(GA-7101; EURAEC-1634; QPR-4) CFSTI: HC $3.00/MF $0.65

Results of further cold work and heat treatments were the basis of a selection of 0.03 and 0.06 prestrains and 450°C heat treatment for steel irradiations. Capsule and specimen fabrication is continuing. A servovalve and controller were added to the pressurization unit. A modified extensometer was made and is being evaluated. The Charpy instrumentation was tested and is discussed. Warm work of A302-B steel was done at several temperatures and reductions with significant increase in the tensile strength were achieved. NSA

N67-21834# Iowa State Univ. of Science and Technology, Ames.
EFFECT OF OXYGEN CONTENT ON THE LIQUID METAL CORROSION OF MOLYBDENUM
Dale L. Smith, Glenn Murphy, and Ray W. Fisher Aug. 1966 91 p refs
(Contract W-7405-ENG-82)
(IS-1350) CFSTI: HC $3.00/MF $0.65

The effect of impurity oxygen on the liquid-metal corrosion of molybdenum by lead, cadmium, tin, and zinc has been determined experimentally. Static corrosion tests were conducted with electron-beam welded 0.75-in. OD by 0.035-in. wall by 2-in. long molybdenum capsules containing the four low-melting metals. The majority of the tests were conducted for 300 hours at temperatures of 700 or 800°C. The oxygen content of the liquid metals was varied from six to 10,000 parts per million. The mechanisms by which the oxygen may interact are discussed and the results of the experimental tests are explained in terms of these mechanisms. The oxygen in the lead-molybdenum system formed a lead molybdate ($PbMoO_4$) surface layer, which tended to protect the molybdenum from solution attack. Oxygen in the cadmium formed cadmium molybdate ($CdMoO_4$), which did not adhere to the surface and thus increased the corrosion slightly. Simple solution attack of molybdenum occurred with low-oxygen (8 ppM) tin; however, a compound boundary-layer formation was noted in the high-oxygen tests. The zinc diffused rapidly through the molybdenum wall leaving the capsules empty after 100 hours at 700°C. The presence of oxygen in the zinc appeared to decrease the diffusion rate of the zinc slightly. Author (NSA)

N67-21845# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
POWDER METALLURGY
M. Bal'shin and M. Rybal'chenko 31 Oct. 1966 8 p Transl. into ENGLISH from Ekon. Gaz. (Moscow), no. 41, 10 Oct. 1964 p 20
(FTD-HT-66-641; TT-67-60713; AD-646294) CFSTI: HC $3.00/MF $0.65

Metallurgic powders are formed into parts and sintered at a temperature lower than the melting temperature of the metal. Only one kilogram of powdered parts is produced for every ton of metal obtained by ordinary means. Powders are used in manufacturing a number of objects resulting in multiplying labor

productivity, expanding the circle of machineable materials and obtaining parts of a precise form which do not require dressing on machine tools. Several examples of the economic advantage of powdered metals are cited. The role of fiber metallurgy in comparison with powder metallurgy is given along with requirements for metals which must withstand very high temperature. The possibilities of powdered metals playing a role in the Soviet economy is discussed. TAB

N67-21861# Drexel Inst. of Tech., Philadelphia, Pa. Dept. of Metallurgical Engineering.
FRACTURE OF METALS DURING DEFORMATION PROCESSING UNDER CONDITIONS OF HOT WORKING
G. E. Dieter and E. Shapiro 30 Nov. 1966 60 p refs
(Contract NOw-66-0207-d)
(AD-804328) CFSTI: HC $3.00/MF $0.65

The hot fracture of Inconel 600 and Waspaloy has been studied over the temperature range from 800 to 2200°F using a hot torsion tester that is capable of superimposing either axial tensile or compressive stresses on the torsional shearing stresses. Microscopic studies of fracture initiation have been made over the entire temperature region. From 800 to 1200°F fracture initiates at inclusions and propagates by transgranular shear. In the temperature region of minimum ductility, 1300–1500°F, fracture initiates at grain boundaries and propagates readily in an intergranular manner. At 1600°F and above, fracture initiates easily at grain boundaries, but because recrystallization intervenes crack propagation is difficult and strain to fracture is high. Microcracks initiate at the peak in the torque-twist curve. The higher the temperature the smaller is the strain at which fracture initiates. Correlations have been found between the stress state and the shearing strain at crack initiation and total fracture strain. These correlations show the strong influence of a compressive normal stress on retarding crack initiation and resisting crack propagation. Author (TAB)

N67-21875# Marine Engineering Lab., Annapolis, Md.
METAL CORROSION IN DEEP-OCEAN ENVIRONMENTS Research and Development Report
W. L. Wheatfall Jan. 1967 31 p refs
(MEL-429/66; AD-645481) CFSTI: HC $3.00/MF $0.65

Experiments were conducted in deep-ocean environments to determine whether unusual corrosion phenomena exist at great depths that are not present in water near the surface. A total of five exposures were made at various locations in the Pacific Ocean. Two exposures were at 5640 feet, and one each at 2340, 5300, and 6780 feet. In some cases, similar tests were conducted in shallow water. Results from general corrosion tests of metals representing six typical alloy classes, and also from crevice-corrosion tests on a stainless steel and nickel alloy, revealed that, in general, there were no major differences between corrosion phenomena in deep-ocean and shallow-water environments. Variations in behavioral patterns that were observed could largely be explained on the basis of differences in oxygen content. TAB

N67-21880# General Electric Co., Philadelphia, Pa. Missile and Space Div.
THE HYPERSONIC OXIDATION AND VAPORIZATION OF METALLIC PARTICLES
Leon M. Gilbert Nov. 1966 47 p refs
(Contracts AF 04(694)-916; AT(30-1)-3535)
(R66SD62; AD-804980) CFSTI: HC $3.00/MF $0.65

In this study an analysis is presented which leads to theoretical predictions of heat transfer rates, oxidation rates, and vaporization rates experienced by metallic particles during hypersonic entry into the earth's atmosphere. The particular metals included in the analyses are: aluminum, beryllium, titanium, and an austenitic stainless steel. Equations are presented which provide for the evaluation of the heating rates and mass transfer rates in the free molecular, the near-free molecular, the transition, the low Reynolds number and the high Reynolds number fluid dynamic flow regimes at arbitrary body stations on spheres and unyawed cylinders. Author (TAB)

18 MATERIALS, NONMETALLIC

Includes corrosion; physical and mechanical properties of materials (e.g., plastics); and elastomers, hydraulic fluids, etc. For basic research see: 06 Chemistry. For related information see also: 17 Materials, Metallic; 27 Propellants; and 32 Structural Mechanics.

N67-20584# Pennsylvania State Univ., University Park. Materials Research Lab.
ANISOTROPY AND STRENGTH OF CERAMIC BODIES. INTRINSIC BRITTLE STRENGTH OF MAGNESIA BICRYSTALS
W. R. Buessem, H. A. McKinstry, and F. F. Lange 15 Sep. 1966 167 p refs
(Contract Nonr-656(27))
(TR-2; AD-643078) CFSTI: HC $3.00/MF $0.65

The intrinsic strength of grainbounderies of MgO-bicrystals was studied. The grainboundary strength was found to be 370,000 psi or approximately the same as the single crystal. The attempt to relate the grainboundary strength to the five orientation parameters was not complete. Author (TAB)

N67-20587# Rocketdyne, Canoga Park, Calif.
HIGH-MODULUS GLASSES BASED ON CERAMIC OXIDES Final Report, 13 May 1965–31 Jul. 1966
S. D. Brown and G. Y. Onoda, Jr. Oct. 1966 94 p refs
(Contract NOw-65-0426-d)
(R-6692; AD-642259) CFSTI: HC $3.00/MF $0.65

An investigation was conducted of glass formation among alumina-base oxide compositions. Modulus measurements were made on those compositions which formed glasses to determine the influence of compositional variations on elastic properties. It was found that the presence of Cao and a small amount (< 10 percent) of Sio2 as components was necessary for good glass formation. Among other components considered, Li2o and Mgo had the greatest effect on increasing the specific and absolute modulus, respectively. In analyzing the dependence of modulus on composition, a useful correlation between Youngs modulus and the true ionic volume fraction was found with which certain predictions could be made concerning the effect of various components on modulus. The most promising glass found was one containing Mgo (Glass R105). This glass has a modulus of 16 million psi, a specific modulus of 5.5 million psi and a specific gravity of 2.9. Strength, static fatigue, water durability, devitrification temperature, fiberizability, and reactivity with potential container and bushing materials were also evaluated for this glass. Author (TAB)

N67-20613# Whittaker Corp., San Diego, Calif. Narmco Research and Development Div.
MICROMECHANICAL BEHAVIOR OF FIBER REINFORCED PLASTICS Final Report, 14 Jun. 1965–14 May 1966

Juan Haener Sep. 1966 128 p refs
(Contract DA-44-177-AMC-320(T))
(USAAVLABS-TR-66-62; AD-643813) CFSTI: HC $3.00/MF $0.65

The distribution of stresses in a unidirectionally oriented, multifiber composite as a result of process shrinkage and external loads has been analyzed after assuming continuity boundary conditions at the interface and certain hexagonal boundary conditions in the space between the reinforcements. Selected model specimens have been numerically analyzed by computer, and the results have been compared with photoelastic experimental studies. TAB

N67-20622# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
A METHOD OF THERMOSTABILIZATION OF POLYAMIDE FIBER
G. I. Kudryavtsev and V. N. Odnoralova 2 Sep. 1966 6 p Transl. into ENGLISH from Russian Patent no. 167952 (Appl. no. 894503/23-5, 11 Apr. 1964) p 1–2
(FTD-HT-66-89; AD-643899) CFSTI: HC $3.00/MF $0.65

The invention involves the stabilization of polyamide (nylon) fibers to high temperatures by grafting N-formyl amidoacrylic acid to the fibers, and by subsequently treating the grafted fibers with copper or calcium acetate. TAB

N67-20656# Ballistic Research Labs., Aberdeen Proving Ground, Md.
HUGONIOT DATA FROM SHOCK-INDUCED POLARIZATION EXPERIMENTS WITH GAMMA-IRRADIATED POLYETHYLENE
George E. Hauver Oct. 1966 17 p refs
(BRL-TN-1628; AD-643522) CFSTI: HC $3.00/MF $0.65

Low-density polyethylene specimens were exposed to air to gamma radiation in order to produce polar oxide surface regions which generated polarization signals where subjected to intense shock compression. Shock velocities were obtained by polarization measurements, and Hugoniot points between 75 and 192 kilobars were established by graphical procedure. Measurements at 94 kilobars indicated were established by graphical procedure. Measurements at 94 kilobars indicated that radiation doses below 2.0 x 10 to the 8th power rads had negligible effect on the Hugoniot. Author (TAB)

N67-20661# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
NEW MATERIALS IN ENGINEERING
Ye. B. Trostyanskaya, B. A. Kolachev, and S. I. Sil'vestrovich 14 Sep. 1966 942 p refs Transl. into ENGLISH of the publ. "Novyye Materialy v Tekhnike" Moscow, Gostoptekhizdat., 1962 656 p
(FTD-HT-66-269; TT-67-60219; AD-643685) CFSTI: HC $3.00/MF $0.65

This textbook has been prepared by a large staff of specialists to describe the new materials which are gaining acceptance in the various branches of engineering - plastics, rubbers, protective coatings, ceramic materials, glass and fiberglass, bonding materials, cermets, semiconductors, titanium, zirconium and similar new alloys. Specifications are presented for the new materials that have found application, as well as for materials of promise, for which we present their properties, and the methods and areas of their application. TAB

N67-20697# Naval Research Lab., Washington, D. C.
SURFACE VISCOSITY OF POLYDIMETHYLSILOXANE MONOLAYERS
N. L. Jarvis 23 Sep. 1966 11 p refs
(NRL-6430; AD-643847) CFSTI: HC $3.00/MF $0.65

The surface viscosities of a series of polydimethylsiloxanes were studied using a canal viscometer as well as a torsional surface viscometer. The siloxane monolayers investigated had molecular weights ranging from 520 to approximately 105,000 and included both the ethoxy and trimethyl end-blocked polymers. The surface viscosity of even the highest molecular weight polydimethylsiloxane monolayer was extremely low, below the limit of sensitivity of the canal viscometer, which is of the order of 0.0001 surface poise. This surface viscosity is remarkably low when compared with monolayers of other polymeric materials that have been studied at the water/air interface. Many of these polymers such as poly-e-capramide (6-nylon), the proteins, and synthetic polypeptides have given highly viscous, or viscoelastic, non-Newtonian films even at film pressures of only a few dynes/cm. The low surface viscosity of the siloxanes reflects the relatively low intermolecular cohesion that exists between adjacent siloxane chains in a monolayer. This low surface viscosity may in part explain the defoaming and antifoaming ability of the polydimethylsiloxane fluids. Author (TAB)

N67-20699# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
EFFECT OF GAMMA RADIATION ON THE DIELECTRIC PROPERTIES OF VACUUM-DENSE CERAMICS
B. I. Vorozhtsov and I. S. Filatov 24 Aug. 1966 12 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Fiz. (Tomsk), no. 3, 1964 p 7–11
(FTD-HT-66-37; TT-67-60242; AD-643924) CFSTI: HC $3.00/MF $0.65

Conclusions: (1) A notable change in the properties of ceramics both after the action of gamma rays and at the moment of radiation by gamma rays in a weak field brought about by the breakdown in the structure of the material through the effect of the glass phase with the formation of centers of coloration is possible only through radiation with a powerful dose (greater than 1,000,000 R), in this situation the relaxation losses decrease and the losses in conductivity somewhat increase. (2) In the area of powerful fields at the moment of radiation with gamma rays even an insignificant dose of radiation 2.25, 10,000) leads to a sharp increase in epsilon and tg delta on account of the strong dependence of the processes of ionization of the gas in the pores of the material in a high-frequency electrical field on the action of an outside ionizer. Author (TAB)

N67-20723# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
THE EFFECT OF OXIDATION, THERMAL CYCLING, AND IRRADIATION ON SILICON CARBIDE (SiC) COATED GRAPHITE
J. L. Jackson Aug. 1966 7 p refs
(Contract AT(45-1)-1830)
(BNWL-242) CFSTI: HC $3.00/MF $0.65

A study of several commercial SiC coatings on graphite substrates showed that the best coatings were 5 to 10 mils thick and had no sharp corners. These coatings were best applied to substrates whose thermal expansion was close to that of SiC. Good coatings with the above characteristics were affected very little by thermal cycling, oxidation, or irradiation. Author (NSA)

N67-20735# Johns-Manville Research Center, Manville, N. J.
DEVELOP 1800 F-400F FIBROUS-TYPE INSULATION FOR RADIOISOTOPE POWER SYSTEMS Quarterly Progress Report, 1 Jul.–30 Sep. 1966
J. O. Collins 3 Oct. 1966 44 p refs
(Contract AT(30-1)-3633)
(ALO-3633-2; QPR-2) CFSTI: HC $3.00/MF $0.65

Eleven experimental MIN-K formulations were investigated for processing technique, strength and moldability. Two formulations have been tentatively chosen as suitable for 1400°F continuous service, one for bulk insulation application with good strength characteristics, and one for intricate T/E module application. The equipment required for compression–deflection tests, outgassing and compatibility tests, and thermal conductivity measurements are presented, and the results of their initial startups are discussed. Author (NSA)

N67-20751# Union Carbide Corp., Parma, Ohio. Carbon Products Div.

EFFECTS OF NEUTRON DAMAGE ON THE MECHANICAL PROPERTIES OF PYROLYTIC AND SINGLE CRYSTAL GRAPHITE Annual Progress Report, 1 Jul. 1965–30 Jun. 1966

J. T. Meers 15 Jul. 1966 51 p refs

(Contract AT(40-1)-3237)

(TID-23388) CFSTI: HC $3.00/MF $0.65

An analysis was made of the optical reflectivity method for measuring the c-axis misorientation of pyrolytic graphite. The static shear apparatus was revised to allow measurement of both shear modulus and shear strength of single crystals. The ultrasonic method was also used successfully for the determination of the shear modulus of single crystals. The static torsion apparatus for the testing of pyrolytic graphite was automated to make the testing more convenient. Calculations were made to determine the feasibility of measuring c_{13} on compression-annealed pyrolytic graphite; with present measuring techniques, a reliable value of c_{13} probably cannot be obtained directly from experiment. Specimens for the irradiation program were prepared; results of the preirradiation tests are reported. Author (NSA)

N67-20805# Oak Ridge National Lab., Tenn.

MEASUREMENT OF DIMENSIONAL CHANGES OF PYROLYTIC CARBONS INDUCED BY RADIATION (GRAPHITE RIG 3, BR 2 MOL/BELGIUM)

W. Delle [1966] 15 p refs Transl. into ENGLISH of Julich Nucl. Res. Center, THTR Proj., Sect. no. 2.04, Rept. no. 4

(ORNL-TR-1347)

Descriptions of measurement methods including those using microscopes are presented. A review of the measuring programs at ORNL and at the Nukem company is presented. Results of investigations indicate that unsupported samples of the pyrolytic C shrink and crack more than those laminated on graphite for support. Data are included on shrinkage of ORNL and Nukem samples. NSA

N67-21008# Brookhaven National Lab., Upton, N. Y.

PRODUCTION OF POLYETHYLENE AND RELATED COMPOUNDS BY RADIATION AT THE BROOKHAVEN NATIONAL LABORATORY

Donald J. Metz [1966] 13 p refs Presented at the Nederlands Atoomforum Conf., Utrecht

(Contract AT(30-2)-GEN-16)

(BNL-10591; CONF-660312-7) CFSTI: HC $3.00/MF $0.65

The underlying philosophy for studying the production of polyethylene and other compounds by radiation is discussed. Preliminary data obtained are given along with a list of copolymers with ethylene that have been formed. The economics of a plant constructed to produce polyethylene using cobalt-60 as the source of energy for initiating the reaction are also considered. NSA

N67-21148 Royal Aircraft Establishment, Farnborough (England).

GLASS, GLASS CERAMIC AND SINTER GLASS CERAMIC [GLAS, GLASKERAMIK UND SINTERGLASKERAMIC]

Werner Sack Nov. 1966 39 p refs Transl. into ENGLISH from Chem.-Ing.-Tech. (Berlin), v. 37, 1965 p 1154–1165

(RAE-LIB-TRANS-1191) CFSTI: $3.00

The field of glasses in its widest sense is surveyed, including the basic mechanisms of formation, the effect of subconstituents on properties and the design of glasses to meet specific requirements. The processes of network formation and modification, nucleation and sintering are explained in detail and practical examples given for all classes. Author

N67-21188# Royal Aircraft Establishment, Farnborough (England).

TEMPERATURE LIMITATIONS OF POLYMERIC MATERIALS. PART 4: FIBRES

G. Wood Mar. 1965 28 p refs

(RAE-TN-CPM-50)

The temperature limitations of several polymeric materials were studied in view of their importance to the development of systems for deceleration and instrumentation recovery. Analyzed are the thermal stability properties and the aeronautical applicability of the polyamides, polyesters, polyolefines, polyvinyls, polybenzimidazoles, and polyoxadiazoles. Also proposed are methods for improving the service of fibres at high temperatures. S.C.W.

N67-21212# Atomic Energy of Canada, Ltd., Chalk River (Ontario).

WEAR OF PLASTICS IN ROOM TEMPERATURE WATER

J. T. Dunn Feb. 1966 40 p refs

(AECL-2532) CFSTI: HC $3.00/MF $0.65

The wear resistance of 22 self-lubricating plastics was determined in 80 to 160°F high purity water as 3/4 in. sleeve bearings against type 304 stainless steel journals. Carbon filled Tetrafluoroethylene (TFE) and high density polyethylene had the highest wear resistance over the range of loads and speeds used (18–108 lb/in^2 and 8–55 ft/min). In all cases the wear on the stainless steel journals was negligible compared to the wear on the plastic. In 80% of the tests the wear rates decreased with increasing sliding distance. This appeared to be the result of the gradual increase of hydrodynamic lubrication in the bearing wear scar aided by lubrication from transferred films. Filled TFE materials improved in wear resistance after gamma irradiation under water to 1.5 ± 10^7 roentgens while nylon, phenolic, epoxy and Vespel showed a decrease after an exposure of 6×10^7 roentgens. Author

N67-21235# Israel Program for Scientific Translations, Ltd., Jerusalem.

NIKFI PHOTOGRAPHIC MATERIALS FOR AUTORADIOGRAPHY

K. S. Bogomolov, M. Yu. Deberdeev, A. A. Sirotinskaya, V. M. Uvarova, and I. F. Razorenova *In its* The Uses of Radioact. Isotopes and Nucl. Radiation in the U.S.S.R. Vol. III Machine Bldg., Met. 1966 p 57–59 (See N67-21221 10-15) CFSTI: HC $3.00/MF $0.65

Properties of nuclear photographic emulsions, materials available, and techniques are described for autoradiographic procedures used in metallurgical, biomedical, and other scientific research studies. Conditions processing the autoradiographs are outlined. M.W.R.

N67-21342# Massachusetts Univ., Amherst. Polymer Research Inst.

THE MECHANICS OF SPHERULITE DEFORMATION

Rena Yang Aug. 1966 37 p refs

(Contract Nonr-3357(01); Grant DA-ARO(D)-31-124-G469)

(ONR-TR-87; ITR-2; AD-644099) CFSTI: HC $3.00/MF $0.65

The deformation of both tetragonal (fresh film) and hexagonal (aged film) modifications of polybutene-1 spherulites have been studied. The deformations were introduced by uniaxial stretching. The local birefringence of different regions of individual spherulites has been found to be different and its change with strain also varies between the crystalline modifications. Morphological changes with strain are illustrated by microphotographs. The rotation of the maltese extinction cross toward the stretching direction can be accounted for by the rotation of the optic axis toward the stretching direction. Void formation is very pronounced in the hexagonal modification and negligible in that of the tetragonal. Model calculations of birefringences give results agreeing with the experimental values. Finally, the affine deformation behavior was investigated by photographically measuring the changes in spherulitic areas. The changes in shapes of deformed spherulites are shown by interference microscopy and microscopy using polarized light on cross-sections obtained by microtoming. The affine deformation theory has been found to be valid only in low degrees of deformation. Author (TAB)

N67-21345# Alpha Research and Development, Inc., Blue Island, Ill.

INTERFACIAL INTERACTION IN COMPOSITE STRUCTURES Final Report, Feb. 20–Nov. 19, 1966

William S. Layne and Robert L. Patrick 19 Nov. 1966 74 p refs

(Contract NOw-66-0400-c)

(AD-644219) CFSTI: HC $3.00/MF $0.65

A program to examine the fundamental phenomena occurring at the interface of glass-resin composites is continued. The role of water at the interface is being studied by drawing E-glass rod from a melt in an anhydrous atmosphere and using it as a reference material with which to compare E-glass rods subjected to aging, treatments with A-1100 silane and water, and roasting. Model glass-epoxide composites were constructed and examined gravimetrically and radiographically for diffusion of water through them. The influence of the variables mentioned above are also examined by modulus of rupture tests and by scintillation counting, following treatments with tritiated water. Author (TAB)

N67-21350# Springfield Armory, Mass.

DETECTION OF VOIDS AND INHOMOGENEITIES IN FIBER GLASS REINFORCED PLASTICS BY MICROWAVE AND BETA-RAY BACKSCATTER TECHNIQUES

Kenneth A. Fowler and Harold P. Hatch 20 May 1966 47 p refs

(SA-TR19-1519; AD-644419) CFSTI: HC $3.00/MF $0.65

Microwaves were used as a means of detecting voids and inhomogeneities in fiber glass reinforced plastics. A number of experiments that were designed to empirically establish the limits of detectability of various types of defects are described. Based on the results of the investigation, it is possible to detect a 1/8-inch-diameter hole in a 1/4-inch-thick panel of fiber glass reinforced plastic with X-band microwaves. However, several factors such as sensitivity of the signal amplitude to defect location, test-piece position, geometry, and homogeneity make interpretation of results difficult. Beta-ray backscatter measurements are potentially useful as a means of detecting local variations in glass-to-resin ratio. The contribution of fillers as a third constituent in the composite system must, however, be considered in establishing a relation between backscattering and glass-to-resin ratios. Author (TAB)

N67-21358# Naval Ammunition Depot, Crane, Ind.

BINDING PROPERTIES AND OTHER CHARACTERISTICS OF SEVERAL POLYESTER RESIN BINDERS USED IN PYROTECHNIC FORMULATIONS

Davey Haas 28 Oct. 1966 36 p

(RDTR-51; AD-644612) CFSTI: HC $3.00/MF $0.65

The binding strengths of pellets subjected to tensile and shear stresses, and the burning time and candlepower of flares pressed from compound aged 0-6 hours in increments of one hour prior to pressing were determined after curing periods of 5 and 30 days. Three formulations were used, each containing the same ratio of magnesium/sodium nitrate/binder; but, with three different polyester resin binders. The variations in physical strength, candlepower, and burning time with respect to delay time between mixing and pressing were found to be greatest for pellets and candles containing Laminac 4110. Likewise, the physical strength of pellets containing Laminac 4110 was significantly higher than the other pellets after curing 5 days; however, tests after 30 days indicated that by this time the Laminac 4116 had essentially fully cured, and now had binding properties similar to Laminac 4110. All units cured for 16 hours at 150F, and then tested after 5 days exhibited considerably higher strengths than pellets not subjected to an elevated temperature. However, tests after 30 days showed that for the Laminac binders, greater binding strength is obtained by curing at room temperature for the duration of the curing cycle. Author (TAB)

N67-21439# Massachusetts Univ., Amherst. Polymer Research Inst.

A THEORY OF THE MECHANICAL PROPERTIES OF SPHERULITES Interim Technical Report

Tatsuro Kawaguchi Apr. 1966 36 p refs

(Contract DA-ARO(D)-31-124-G469)

(ONR-TR-88; ITR-3; AD-644098) CFSTI: HC $3.00/MF $0.65

The mechanical properties of spherulites are calculated from the mechanical properties of the constituent structure which is assumed to be composed of crystalline lamella with transverse isotropy interspersed with isotropic amorphous regions. Using continuum elasticity theory, the mechanical properties of a polymer consisting of an aggregate of such spherulites is calculated from the elastic constants of the crystalline and amorphous regions. Author (TAB)

N67-21445*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.

A STUDY OF THE STRUCTURE OF GRAIN BOUNDARIES IN POLYCRYSTALLINE MAGNESIUM OXIDE

H. T. Smith and M. H. Leipold 15 Apr. 1967 29 p

(Contract NAS7-100)

(NASA-CR-83111; JPL-TR-32-1042) CFSTI: HC $3.00/MF $0.65 CSCL 11B

The structure of the grain boundary in a typical polycrystalline ceramic (MgO) is described in terms of a random network. The development is based on the existence of variable coordination of both species in the structure to permit a stable random network. The theory first develops the energy relationship and coordination distribution in such a network in a stress-free homogeneous environment and then considers the distribution that might exist in a gradient occurring at a discontinuity (grain boundary or free surface). The results suggest that such an approach is capable of describing the conditions at disordered regions in an ordered structure. It appears that the method could be more rigorously developed if needed and, in that case, could be applied to more complex ceramics and used to describe temperature–viscosity relationships in such networks. Finally, the theory indicates that in a theoretically pure MgO, the thickness of the random network at a free surface would be of the order of 2–3 atomic distances, and the total thickness of a grain boundary, of the same order of magnitude. Author

N67-21497# Sandia Corp., Albuquerque, N. Mex.

ADHESION OF ENCAPSULANTS

A. J. Quant Oct. 1966 44 p Presented at the EIVR-10 Meeting, Livermore, Calif.
(Contract AT(29-1)-789)
(SC-DC-66-2326; CONF-661109-1) CFSTI: HC $3.00/MF $0.65

The joint strength of bonds between various combinations of encapsulating resins and substrates as a function of humid and dry, room temperature aging was determined. The encapsulants chosen included all those types that are commonly used. The substrates chosen were representative of materials found in encapsulated packages and of materials in encapsulated cable terminations. Data were obtained on the expected aging and on unmeasured bond strengths as a function of temperature. A study of the accumulated data revealed that no serious problem exists concerning aging effects, wet or dry, on the adhesion of these encapsulants to the various substrates. Author (NSA)

N67-21511# Linde Div., Union Carbide Corp., Indianapolis, Ind.
RESEARCH AND DEVELOPMENT IN A THERMAL INSULATION STUDY Quarterly Progress Report, Jul.–Sep. 1966
W. D. DeWitt 28 Oct. 1966 65 p refs
(Contract AT(30-1)-3632)
(ALO-3632-7) CFSTI: HC $3.00/MF $0.65

Small-scale and large-scale processing tests were completed for the candidate insulation materials except for Ta flake-opacified quartz fiber paper which will be received in the next reporting period. Physical stability tests were completed for these insulation materials. Problems encountered in the establishment of pressure at less than 0.5μ of Hg in the offgassing chamber at 1800°F necessitated the design and fabrication of a new chamber. Preceding solution of the high-temperature operation problem, initial offgassing tests are being conducted at 1000°F. The mass spectrometer gas analyzer was installed. Fabrication of the thermal conductivity testers was completed, and a thermal conductivity test of the insulation composite Ni foil-quartz cloth was initiated. A review of heater element design and selection is under way because of difficulties encountered in the handleability of W wire. Calculations were made to determine an optimum layer density of the insulation composite Al foil-glass fiber paper. Results of technical discussions indicated that the problem of oxidation remains as the most significant one and the use of superalloys appears feasible. A detailed test procedure for the vacuum enclosure task was developed, candidate enclosure test specimens designed, and a design of the test apparatus prepared. Preliminary insulation dynamic tests were successfully completed for the planned insulation composites with the exception of the Ta–Ta flake opacified quartz fiber paper composite. No visual damage to any of the insulation composites tested was observed. The tasks to be performed during the next quarterly reporting period are discussed. Author (NSA)

N67-21628# Whittaker Corp., San Diego, Calif. Narmco Research and Development Div.
MATERIAL DEVELOPMENT Final Report, Mar. 15, 1963–Mar. 1, 1965
John R. O'Neal Nov. 1966 94 p Prepared for Sandia Corp.
(Contract AT(29-1)-789)
(SCL-CR-66-91) CFSTI: HC $3.00/MF $0.65

Properties of polybenzimidazole-boron moldings were evaluated. The material was studied for thermal reactions, optimization of advancement, molding properties, and mechanical and physical tests were made on molded specimens. No reaction occurred between polybenzimidazole and boron when heated up to 1000°F. The volatile content of polybenzimidazole had to be reduced to approximately 1% before dense moldings could be made. Polybenzimidazole–boron moldings had approximately twice the mechanical strength of commercially available phenolic molding compounds. All the residual stresses could not be relieved in the moldings, but removing them from the mold at 700°F and cooling in a 600°F oven resulted in significant improvement. Annealing moldings at 800°F was not sufficient to reduce their stresses. Since this material has a heat deflection temperature of 920°F, 1000°F may be required to relieve stresses. Compressive specimens of composities deformed at 800°F; therefore, it may be possible to postform molded sheet to any desired shape. Dense moldings, greater than 0.25 in. in thickness, were difficult to make. If thicknesses greater than 0.25 in. are required, laminated molded layers may be the solution. It was concluded that moldings should be annealed by raising the temperature from room temperature to 1000°F. Annealing to 1000°F eliminated almost all the stress in a 12-in.×12-in.×5/16-in. molding and then flexural specimens were easily cut without stress cracking of the molding. The molding was placed in a steel bag inside an oven. The bag was purged with argon at 3 l/minute and the oven temperature raised from room temperature to 300°F at 3°F/minute. This temperature was held 20 minutes, then increased 50°F at 3°F/minute. The temperature was increased in 50°F steps with 20 minutes at each temperature until 1000°F was reached. At 1000°F the oven was turned off and allowed to cool with the door closed. Then at 300°F the argon was stopped and the molding removed. Author (NSA)

N67-21700# Institute of Modern Languages, Inc., Washington, D. C.
OPTICAL BORIC GLASS WITH HIGH REFRACTION INDEX [OPTICKE BORITE SKLO S VYSOKOU LOMIVOSTI]
Werner Vogel and Wolfgang Heindorf Ft. Belvoir, Va., Army Eng. and Develop. Labs., Dec. 1966 7 p Transl. into ENGLISH from Czechoslovakian patent no. 112797, Pt. 32b, 3/14, 1964
(Contract DA-44-009-AMC-1563(T))
(ERDL-T-1880-66; AD-644150) CFSTI: HC $3.00/MF $0.65

The object of this invention are boric glasses with high refraction index and medium dispersion, the optical qualities of which indicated in diagram vd-nd lie in the fields where until now only a few technically usable glasses have been known. TAB

N67-21723# Grumman Aircraft Engineering Corp., Bethpage, N. Y. Research Dept.
THE EFFECT OF ELECTROPOLISHING ON THE TENSILE PROPERTIES AND FRACTURE CHARACTERISTICS OF BORON FILAMENTS
Alvin A. Machonis Oct. 1966 41 p refs
(RE-270; AD-800947) CFSTI: HC $3.00/MF $0.65

The brittle nature of boron filaments suggests that the fracture stress is very structure-sensitive. Furthermore, the surface condition is one of the more influential structural parameters. To determine the influence of the dimpled, as-deposited surface of boron filaments on tensile and bend strength of the filaments, mechanical tests were conducted on acid-etched, electro-polished, and 'as-received' specimens. Electropolishing definitely improved both the tensile and bending strength of any grouping of specimens that in the 'as-received' condition tended to fail by surface-initiated fracture. Filaments that tended to fracture just below the surface showed an increase in bend strength when electropolished. Micrographs show that the tensile strength increases as the fracture mode changes from a surface initiated fracture to a subsurface failure to an internally initiated fracture. Author (TAB)

N67-21758# Eidgenossische Technische Hochschule, Zurich (Switzerland).
THE INFLUENCE OF CONSTITUTION ON THE UNDISTURBED DIMENSIONS OF POLYMERS [KONSTITUTIONSEINFLUESSE AUF DIE UNGESTOERTEN DIMENSIONEN VON POLYMEREN]
Otto Etter (Ph.D. Thesis) 1965 72 p refs In GERMAN
(Rept.-3739) CFSTI: HC $3.00/MF $0.65

In an investigation of unperturbed states or conditions, experimental techniques and measuring methods are presented for several polymers. The influence of polarizability of substitutions on polystyrol and polyvinyl cyclohexane was observed. The production of polyvinyl cyclohexane from polystyrol was studied and, in particular, the hydrogenation condition of the specified nickel catalyst was determined. Acryl acid ethyl ester was polymerized through ultraviolet irradiation. The polystyrol was obtained through anion polymerization. It was pointed out that the theta condition is not identical with the unperturbed condition, but that the theta condition is dependent on solvent action. A method was developed to arrive at the unperturbed condition from the theta condition. It seems that the slight influence of configuration (different arrangement of the CH_3 group) has no influence on the unperturbed dimensions of a marcomolecule. Transl. by R.Ll.

N67-21821# Southern Research Inst., Birmingham, Ala.
AN INVESTIGATION OF THE MECHANICAL BEHAVIOR OF GRADES RVD AND AGOT GRAPHITES Final Report
John D. Woodward 20 Apr. 1966 166 p Prepared for Union Carbide Corp., Oak Ridge, Tenn.
(Contract AT(40-1)-2076)
(Rept.-7744-1691-VI; TID-23288) CFSTI: HC $3.00/MF $0.65

The evaluation of RVD graphite covered the range in temperature from 1000 to 5500°F and consisted of short-time uniaxial response at constant strain rate in tension and compression, short-time uniaxial response with a change of strain rate in tension and compression, uniaxial creep response in tension and compression, uniaxial response under cyclic loads in tension, uniaxial response with a period of stress relaxation in tension, short-time torsional response with a constant axial tensile load, and the dynamic modulus of the material. For AGOT graphite, short-time uniaxial evaluations were performed from 70 to 4500°F, and shear evaluations were performed at 70°F. Bulk density was determined for all specimens. Author (NSA)

N67-21848# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
POLYBENZIMIDAZOLE STRUCTURAL ADHESIVES FOR BONDING STAINLESS STEEL, BERYLLIUM AND TITANIUM ALLOYS Technical Report, Feb. 1962–May 1965
Sidney Litvak Mar. 1966 43 p
(AFML-TR-65-426; AD-645241) CFSTI: HC $3.00/MF $0.65

A new high-temperature-resistant adhesive for the binding of stainless steel, beryllium and titanium alloys has been developed. This report reviews the applied research leading to this development, and presents initial information on the mechanical properties of metal-to-metal bonded specimens, lap-shear and sandwich, from room temperature to 1000F for short-time and long-time aging periods at both 600F and 700F. TAB

N67-21862# Lockheed Missiles and Space Co., Sunnyvale, Calif.
ON THE RHEOLOGY OF A VISCOELASTIC MEDIUM
A. A. Vakulenko and V. M. Chebanov 18 Nov. 1965 5 p Transl. into ENGLISH from Mekh. Tverdogo Tel, no. 4, 1966 p 127–129
(AD-644173) CFSTI: HC $3.00/MF $0.65

The most general of the rheological relationships which are utilized in the mechanics of a viscoelastic medium results from the Boltzmann superposition principle. As is known, this principle has formal reasoning at its base to a considerable degree. But with such foundations the superposition principle admits of further extensions, one of which is considered. A scheme and some test results are presented which permit clarification of the sphere of operation of this extension in application to real materials whose behavior during deformation processes is viscoelastic to a sufficient degree. Author (TAB)

19 MATHEMATICS

Includes calculation methods and theory; and numerical analysis. For applications see: 08 Computers.

N67-20529# Harvard Univ., Cambridge, Mass. Dept. of Statistics.
APPROXIMATING THE BINOMIAL, F, AND COMMONLY USED RELATED DISTRIBUTIONS, I
David B. Peizer and John W. Pratt Aug. 1966 63 p refs
(Contract Nonr-1866(37); Grant NSF G-24035)
(TR-12; AD-643954) CFSTI: HC $3.00/MF $0.65

The paper concerns a new Normal approximation to the beta distribution and its relatives, in particular, the binomial, Pascal negative binomial, F, t, Poisson, gamma, and chi square distributions. The approximate Normal deviates are expressible in terms of algebraic functions and logarithms, but for desk calculation it is preferable to use an equivalent expression in terms of a function specially tabulated here. The t distribution and its relatives are handled by a special method, for which further tables are given. Graphs of the error are provided. They show that the approximation is good even in the extreme tails except for beta distributions which are J or U shaped or nearly so, and they permit correction to obtain still more accuracy. Further graphs compare various Normal approximations. Some classical continued fractions and some standard recursive relations which may occasionally be useful are also given. Everything an ordinary user of the approximation might want to know is included in this paper. The theory behind the approximation and most proofs are postponed to a second paper immediately following this one (AD-643 955). Author (TAB)

N67-20566# Wisconsin Univ., Madison. Mathematics Research Center
AN APPLICATION OF THE GENERAL THEORY OF APPROXIMATION METHODS TO THE STUDY OF THE PROBLEM OF DETERMINATION OF PROPER VALUES AND PROPER VECTORS
E. A. Troickaja Jul. 1966 14 p refs
(Contract DA-11-022-ORD-2059)
(MRC-TSR-665; AD-642905) CFSTI: HC $3.00/MF $0.65

The proper (or characteristic) value-vector problem for a linear operator is formulated as a nonlinear equation in the product of a Banach space and its scalar field. The solution of this equation by Newtons method is considered, and the theorem of L. V. Kantorovic is applied to obtain sufficient conditions for convergence and error estimates. The problem of finite - dimensional approximation of an operator on a space of infinite dimension is also considered. Author (TAB)

N67-20567# California Univ., Berkeley. Operations Research Center.
THE k SHORTEST ROUTES AND THE k SHORTEST CHAINS IN A GRAPH
Michel Sakarovitch Oct. 1966 24 p refs
(Contract Nonr-222(83); Grant NSF GP-4593)
(ORC-66-32; AD-642823) CFSTI: HC $3.00/MF $0.65

An algorithm to construct the k shortest routes from O to D on a graph is described and justified. Since the problem of finding the k shortest chains is of interest in many applications, a variant of the algorithm which exhibits the k shortest chains is also presented. It is emphasized that minor modifications of these two algorithms allow the finding of routes (chains) shorter than a given length. If capacities were to be considered, an immediate application of this last problem could be: what quantity can be shipped from O to D if we demand that the maximum time of travel be less than or equal to a certain given number. A.G.O.

N67-20577# Texas Univ., Austin. Computation Center.
ERROR BOUNDS ON NUMERICAL SOLUTIONS OF DIRICHLET PROBLEMS FOR QUASILINEAR ELLIPTIC EQUATIONS
Thurman Gustav Frank Aug. 1966 150 p refs
(Grants DA-ARO(D)-31-124-G721; NSF- GP-5253)
(ITR-10; AROD-3772-26; AD-642138) CFSTI: HC $3.00/MF $0.65

In this paper, finite difference approximations to Dirichlet problems for quasilinear, uniformly elliptic partial differential equations are studied. Convergence, with decreasing mesh width h, of solutions of finite difference analogues to the solution of the given continuous problem is established by means of bounds on the error in the solutions of the finite difference problems. Author (TAB)

N67-20602# Boeing Scientific Research Labs., Seattle, Wash. Mathematics Research Lab.
A MULTIVARIATE NOTION OF ASSOCIATION FOR GENERAL RANDOM VARIABLES
J. D. Esary, Frank Proschan, and D. W. Walkup Oct. 1966 15 p refs *Its* Mathematical Note No. 490
(DI-82-0578; AD-643976) CFSTI: HC $3.00/MF $0.65

In a previous paper (A multivariate notion of association, with a reliability application) random variables T1,T2,...,Tn were defined to be associated if each pair of non-decreasing functions F(T1,T2,...,Tn), G(T1,T2,...,Tn) have a non-negative covariance. The properties of this definition were studied in the case that T1,T2,...,Tn are finitely discrete, and a sample application to reliability theory was discussed. In the present paper several equivalent definitions of the same notion of association for unrestricted T1,T2,...,Tn are treated. The properties previously obtained, i.e. that association is preserved under the operations of extracting subsets, pooling independent sets, and forming sets of non-decreasing functions, are shown to hold in general. In addition, association is shown to be preserved under limits in distribution. Some additional applications of association are discussed, e.g. previously published results of A. W. Kimball and H. Robbins are obtained. Author (TAB)

N67-20615# Johns Hopkins Univ., Baltimore, Md. Dept. of Statistics
A BAYESIAN APPROACH TO SOME MISSING VALUE PROBLEMS IN ANOVA AND CONTINGENCY TABLES
Daniel A. Bloch Nov. 1966 22 p refs
(Contract Nonr-4010(09))
(TR-62; AD-643852) CFSTI: HC $3.00/MF $0.65

Non-Bayesian procedures for dealing with missing values in ANOVA and contingency tables are well-known. This paper derives the appropriate Bayesian procedures for a randomized block design and for and r x c contingency table. The posterior distributions for the missing observation are given. This paper shows that the classical non-Bayesian procedures do have a simple and natural Bayesian interpretation. Author (TAB)

N67-20617# Case Inst. of Tech., Cleveland, Ohio. Dept. of Mathematics.
CONSISTENCY PROOFS AND REPRESENTABLE FUNCTIONS. PROPERTIES OF STRONGLY REPRESENTABLE FUNCTIONS
C. F. Kent Nov. 1966 110 p refs
(Grant Nonr(G)-00077-64)
(TR-4; AD-643777) CFSTI: HC $3.00/MF $0.65

The paper continues the study of the limitations of axiomatic systems for the expression of classical mathematical truth. Particularly, the strong representability of functions and the provability of their true properties, in classical arithmetic, is investigated. To avoid known difficulties in formalizing recursion theory, a class of recursive defining equations is used which is: first, adequate for the definition of any strongly representable function and, second, allows number-theoretic deductions from the recursion equations to be replaced by theorems of arithmetic. This class is then used to establish, within arithmetic, results in the literature about arithmetic. Author (TAB)

N67-20636# Stanford Research Inst., Menlo Park, Calif. Mathematical Sciences Dept.
AN ALGOL PROCEDURE FOR THE FAST FOURIER TRANSFORM WITH ARBITRARY FACTORS
Richard C. Singleton Dec. 1966 12 p refs
(AD-643997) CFSTI: HC $3.00/MF $0.65

The report consists of an ALGOL procedure with comments. This procedure computes the finite Fourier transform of an n-dimensional complex data vector, using a fast Fourier transform algorithm based on a method proposed by Cooley and Tukey. The dimension n is decomposed into its factors n = n sub 1 . n sub 2 . ... n sub m, and the transform is done in m steps, with n/n sub i transforms of dimension n sub i computed at the i(th) step. Except when n is a prime, the amount of computing is considerably less than for a single transform of dimension n. Author (TAB)

N67-20644# Wisconsin Univ., Madison. Mathematics Research Center.
ON THE VARIATIONAL THEORY OF NONLINEAR OPERATORS AND EQUATIONS
M. M. Vainberg and R. I. Kacurovskii Aug. 1966 16 p refs Transl. into ENGLISH from Dokl. Akad. Nauk SSSR (Moscow), v. 129, no. 6, 1966 p 1199–1202
(Contract DA-11-022-ORD-2059)
(MRC-666; TT-61-10267; AD-642902) CFSTI: HC $3.00/MF $0.65

The variational theory of Hamerstein integral equations is extended to equations with kernels belonging to a class which have a countable number of positive and negative characteristic values. Author (TAB)

N67-20645# Wisconsin Univ., Madison. Mathematics Research Center.
ON VARIATION DIMINISHING SPLINE APPROXIMATION METHODS
Martin Marsden and I. J. Schoenberg Jun. 1966 33 p refs
(Contract DA-31-124-ARO(D)-462)
(MRC-694; AD-642920) CFSTI: HC $3.00/MF $0.65

In Technical Summary Report 625(AD-638 656) Schoenberg introduced a certain class of variation diminishing spline approximations which included as special cases the linear interpolation methods as well as the Bernstein polynomials. Concerning error bounds a few results were there only stated without proofs. Using a new identity for spline functions due to M. Marsden, the authors discuss here the question of convergence and also the closeness of individual approximations. The main result is that the spline approximations of low degree (cubic, for instance) have all the virtues of the linear interpolation method, while providing approximations having any desired number of continuous derivatives. Author (TAB)

N67-20689# Case Inst. of Tech., Cleveland, Ohio. Dept. of Mathematics.
CONSISTENCY PROOFS AND REPRESENTABLE FUNCTIONS, PART I

Clement F. Kent Apr. 1966 61 p refs Revised
(Grant Nonr(G)-00077-64)
(Rept.-220; TR-3; AD-643776) CFSTI: HC $3.00/MF $0.65

The paper lays a basis for studies of incompleteness phenomena manifest in analogues, within axiomatic theories, of known mathematical structures like the group of number theoretic permutations and the Boolean Algebra of subsets of the natural numbers. It establishes the basic facts about functions strongly represented by recursively enumerable formulas of number theory which are consequences of the usual constructive consistency proofs for arithmetic. To do this a pair of new normal form theorems for proofs in arithmetic are established by transfinite induction over the ordinals less than epsilon sub o. As consequences of these theorems, the usual statements of consistency are obtained, including Kreisels no-counterexample interpretation by recursive functionals of finite type. Author (TAB)

N67-20713# Stanford Research Inst., Menlo Park, Calif. Mathematical Sciences Dept.
ALGOL PROCEDURES FOR THE FAST FOURIER TRANSFORM RESEARCH MEMORANDOM
Richard C. Singleton Nov. 1966 20 p refs
(AD-643996) CFSTI: HC $3.00/MF $0.65

The report consists of six Algol procedures with comments. Procedure FASTTRANSFORM computes the complex finite Fourier transform or its inverse, using a modified version of the fast Fourier transform algorithm proposed by Cooley and Tukey. Procedure REALTRANSFORM similarly computes the real Fourier transform and inverse. The remaining four procedures are building blocks used in the first two procedures: they may be combined in other ways, for example, to form procedures for computing convolutions and power spectral density function estimates. The fast Fourier transform is a significant advance over previous methods, in that the number of arithmetic operations is proportional to n $\log_2$ n instead of n^2. Detailed methods of computing this transform are shown here in the language of Algol. A new approach to organizing the computations is used. One that makes practical the solution of large problems in which data overlay within high speed storage will occur. Author (TAB)

N67-21018 Applicazioni e Ricerche Scientifiche, Milan (Italy).
A CATALOGUE OF BURNOUT CORRELATIONS FOR FORCED CONVECTION IN THE QUALITY REGION
G. C. Clerici, S. Garriba (CESNEF), R. Sala, and T. Tozzi Brussels, EURATOM, Dec. 1966 132 p refs
(Contract EURATOM-073-65-11 TEEI)
(EUR-3300-E; EURAEC-1729) CFSTI: $3.00

Burnout correlations for the quality region are listed in their original form, using the same symbols and units of the authors. Conditions for application include the geometry and type of heat flux distribution. Consideration has been limited to the uniform heat flux distribution and to the simplest geometries, i.e. single channels of circular, rectangular, or annular cross section. Symbols and units have been standardized. For each correlation the range of validity of the most important parameters has been given. A first comparison of the correlations for uniform heat flux distribution and round ducts is given. All the correlations have a common range of validity. Author

N67-21062# Kernforshungsanlage, Juelich (West Germany). Zentralinstitut fuer Angewandte Mathematik.
ON THE INITIAL VALUE PROBLEM FOR THE STATIONARY BOLTZMANN–VLASOV EQUATION [UEBER EIN ANFANGSWERTPROBLEM FUER DIE STATIONAERE BOLTZMANN–VLASOV–GLEICHUNG]
H. Neunzert (Tech. Hochschule Aachen) Nov. 1965 55 p refs In GERMAN
(JUL-297-MA) CFSTI: HC $3.00/MF $0.65

The stationary Boltzmann–Vlasov equation was utilized to construct the functions $\phi_+(x,v)$ and $\phi_-(x,v)$ that are defined by the plane (x,v). The function K(x) and the constants c_- and c_+ were given and the equations were formed by assumed values for a given curvature C in the (x,v)-plane. Results showed that a global solution with either ϕ_+ or ϕ_- eliminated, is only possible when K (x) is monotonic decreasing. Transl. by G.G.

N67-21084# Kernforschungsanlage, Juelich (West Germany). Zentralinstitut fuer Angewandte Mathematik.
INVESTIGATIONS OF TURING'S MACHINE IN ITS RELATION TO MARKOV'S ALGORITHMS [UNTERSUCHUNGEN UEBER TURINGMASCHINEN SOWIE DEREN BEZEIHUNGEN ZU MARKOFFSCHEN ALGORITHMEN]
Wilfried Brauer Jun. 1964 67 p refs In GERMAN
(JUL-177-MA) CFSTI: HC $3.00/MF $0.65

Design and performance of a prototype digital computer for series transformation calculations is described and some definitions for the machine-algorithm relationships are given. The similarity of the Turing machine programs and Marko's algorithm is established by obtaining the same series transformation solutions on some algorithms. Transl. by G.G.

N67-21322# Naval Ordnance Test Station, China Lake, Calif.
COMPUTING SCHEMES FOR FACTORIAL AND REGRESSION ANALYSIS AND DEVELOPMENT OF THE UNDERLYING THEORY USING LINEAR METHODS Summary Report, 1957–1965
S. R. Miller and D. R. Cruise Nov. 1966 75 p refs
(NAVWEPS-9001; NOTS-TP-3974; AD-644190) CFSTI: HC $3.00/MF $0.65

The basic concepts of regression and factorial analysis are reviewed and the theory developed, using the notation of linear algebra. The development includes the Gram-Schmidt construction, the linear method of least squares, and the use of orthogonal polynomials. Computing schemes applicable to digital computers are developed, and the basic coding is presented in the FORTRAN language. Fractional replication and the missing value problem are discussed. Author (TAB)

N67-21361# Massachusetts Inst. of Tech., Cambridge. Operations Research Center.
ON THE N-ARMED BANDIT AND OTHER PROBLEMS INVOLVING SEQUENTIAL DECISIONS
Ivan Obregon (Ph.D. Thesis) Oct. 1966 155 p refs
(Contract DA-31-124-ARO(D)-209)
(DSR-75217; TR-24; AD-644430) CFSTI: HC $3.00/MF $0.65

The N-armed bandit problem can be defined as the problem faced by a decision maker who is allowed a given number of opportunities to sample from N populations which generate random variables whose distributions are not known with certainty. If he wants to maximize his expected payoff, what should his strategy be. The paper gives a general formulation which is later specialized to the case where the N random variables have binary distributions. A numerical solution is given and some properties of the optimal strategy are discussed for both finite and infinite processes; finally some near optimal rules are proposed and evaluated. In a second part, the so called action-timing problem and some variants of it are studied. Models with known probability distributions are considered first and then this assumption is relaxed to allow for imperfectly known distributions with adaptive learning built into the policy. Author (TAB)

N67-21456*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
CALCULATION OF CAUCHY NUMBERS
Milton L. Charnow Sep. 1966 4 p ref
(NASA-TM-X-55721; X-542-66-450) CFSTI: HC $3.00/MF $0.65 CSCL 12A

This method for calculating a Cauchy number is based on multiplication of polynomials where (x+1/x) is represented as: 20000000+01 + 10000000+01 + 51505050+08 +10000000+01 + 49505050+08. The floating point representation of two is the number of terms in the series. One is the numerical coefficient and 51505050+08 represents x to the first power. G.G.

N67-21591# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics.
TWO-CENTER PROBLEM OF QUANTUM MECHANICS, MATHEMATICAL PART [ZADACHA DRUKH TSENTROV KVANTOVOI MEKHANIKI, MATEMATICHESKAYA CHAST]
L. I. Ponomarev and T. P. Puzynina 1966 27 p refs In RUSSIAN
(JINR-P2-3012) CFSTI: HC $3.00/MF $0.65

An algorithm is given to calculate the eigenvalues and the wave functions of the two-center problem as well as the matrix elements by these functions. The method of solving the Sturm–Liouville problem for two coupled differential equations of the second order, which is developed here for this case, can be used for other problems. Author

N67-21635# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics.
TO THE THEORY OF 2(2S+1)-COMPONENT FREE QUANTIZED SPINOR FIELDS. I [K TEORI KVANTOVANNYKH SPINORNYKH POLEI.]
L. Sh. Khodzhaev 1966 18 p refs In RUSSIAN
(JINR-P2-3010)

The 2(2S+1)-component free spinor fields are formulated using the group theory and the theory of functionals. This approach may be used for further investigation of covariant structure of casual S-matrix elements. Author (NSA)

N67-21694# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE CALCULATION AND DESIGN OF CYLINDRICAL MATRICES OF STAMPS FOR COLD PRESSING WITH HARD-ALLOY INSERTS
V. A. Mishunin 27 Sep. 1966 16 p refs Transl. into ENGLISH from Kuznechno-Shtampovochnoye Proizv. (USSR), no. 1, 1965 p 5–9
(FTD-HT-66-398; TT-67-60302; AD-644050) CFSTI: HC $3.00/MF $0.65

The partial failures in putting the process of cold pressing into production are connected with the low resistance and frequent breakdowns of the instrument. Most recommendations lack calculation-supported data on the selection of the ratio of the geometric parameters of the matrix elements, the clearances on adjacent surfaces, and the optimal design diagram. A method is discussed for calculating and selecting the design diagrams of cylindrical matrices of stamps for cold pressing with hard-alloy inserts which overcomes this obstacle and gives practical aid to factory designers and technicians. TAB

N67-21696# Queens Univ., Belfast (Northern Ireland). Dept. of Applied Mathematics.
AN EXPANSION METHOD FOR CALCULATING ATOMIC PROPERTIES. VII: THE CORRELATION ENERGIES OF THE LITHIUM SEQUENCE
C. D. H. Chisholm and A. Dalgarno 23 Oct. 1965 23 p refs (Contract AF 61(052)-780)
(AFCRL-66-819; SR-13; AD-644515) CFSTI: HC $3.00/MF $0.65

If the energy of an atomic system is expanded in inverse powers of the nuclear charge Z, the leading term of the correlation energy after degeneracies have been removed is a constant which can be expressed as a weighted sum of electron pair energies and certain non-additive terms. The pair energies may be obtained from direct two-electron variational calculations and the non-additive terms may be evaluated exactly. Calculations are carried out for the lithium doublet-S sequence with the result that the non-relativistic eigenvalues are given by E(Z) = - 1.125Z sq. + 1.02280521Z - 0.40814899 + 0 (1/Z). Author (TAB)

N67-21701# Boeing Scientific Research Labs., Seattle, Wash. Mathematics Research Lab.
AN EFFECTIVE ALGORITHM FOR MINIMIZATION
A. A. Goldstein (Washington Univ.) and J. F. Price Sep. 1966 15 p refs *Its* Math. Note No. 483
(D1-82-0566; AD-643973) CFSTI: HC $3.00/MF $0.65

An algorithm is proposed for minimizing certain nice C2 functions f on En assuming only a computational knowledge of f and grad f. It is shown that the algorithm provides global convergence at a rate which is eventually superlinear and possibly quadratic. The algorithm is purely algebraic and does not require the minimization of any functions of one variable. Numerical computation on specific problems with as many as six independent variables has shown that the method compares very favorably with the best of the other known methods. The method is compared with the Fletcher and Powell method for a simple two dimensional test problem and for a six dimensional problem arising in control theory. Author (TAB)

N67-21714# California Univ., Berkeley.
THE STEENROD SQUARES IN THE MOD TWO COHOMOLOGY ALGEBRA OF AN H-SPACE
Emery Thomas 1966 8 p refs Presented at Colloq. de Topologie, Brussels, 7–10 Sep. 1964 Reprinted
(Grant AF-AFOSR-336-63)
(AFOSR-66-2357; AD-642813) CFSTI: HC $3.00/MF $0.65

This work attempts to answer the question: What is the structure of H*(X, Z sub p) as an A(p) - algebra for the case p =2. Here A(p) denotes the mod p Steenrod algebra, and X and H-space. Let H*(X) denote the mod 2 cohomology algebra of X. A central theorem along these lines states that: If X is an H-space such that H*(X) has a primitive set of generators, V is a primitive class of odd degree, and t an integer such that (deg V-t) = 1 mod 2. TAB

N67-21726# Michigan State Univ., East Lansing.
AN ITERATIVE PROCESS OF HIGH ORDER
Herman Rubin 30 Aug. 1966 6 p
(Contract Nonr-2587(02))
(RM-170; HR-17; TR-12; AD-644406) CFSTI: HC $3.00/MF $0.65

An iterative procedure is given for the solution of f(x) + Ax + B = 0 which is of 5th order if f(0) and f(0) not equal 0, of order 2 1/2 if f(0) not equal 0 and f(0) = 0, and of high order if the initial approximation satisfies f(0 sub 0) = 0 and f is not zero. Author (TAB)

N67-21732# Illinois Univ., Urbana. Coordinated Science Lab.
PARAMETER SENSITIVITY OF LINEAR, TIME-INVARIANT, DYNAMIC SYSTEMS
Devender Chinchode Reddy Sep. 1966 100 p refs
(Contract DA-28-043-AMC-00073(E); Grant AF-AFOSR-931-66) (R-315; AD-644517) CFSTI: HC $3.00/MF $0.65

Several possible sets of sensitivity functions are defined both in the frequency domain and state space representation of the system. These functions relate small changes in system parameters, that inevitably occur in the assembly of the operation of a plant, to the characteristic roots of the system or some measures of system performance. The linear or approximately linear dynamical system is specially the object of the investigation. A new approach for the analysis of system behavior when subjected to parameter variations is indicated. The necessary and sufficient conditions for a totally parameter invariant response in the presence of small but arbitary parameter changes are derived. Finally, the new approach of analysis is applied to a practical problem of interest, and a possible synthesis procedure is indicated for the reduction of sensitivity to parameter changes. Author (TAB)

N67-21749# Kernforschungsanlage, Juelich (West Germany). Institut fuer Plasmaphysik.

MECHANICAL DETERMINATION OF THE COEFFICIENTS OF THE FORMAL POWER SERIES LOG $e^x e^y$ [MASCHINELLE BERECHNUNG DER KOEFFIZIENTEN DER FORMALEN POTENYREIHE LOG $e^x e^y$]

J. Poetsch and W. V. Waldenfels Nov. 1964 16 p refs In GERMAN

JUL-206-PP) CFSTI: HC $3.00/MF $0.65

The coefficients of the formal power series log e^x and e^y, where x and y are not permuted indeterminates, were calculated and tabulated with the help of the IBM 1620 electronic computer, of the Plasma Physics Institute in Julich. The very simple program can be applied to other power series. Transl. by R.Ll.

N67-21752 Eidgenossische Technische Hochschule, Zürich (Switzerland).

MATHEMATICAL INVESTIGATIONS FOR THE DETERMINATION OF CLASS SCHEDULES AND TRANSPORTATION TIMETABLES [MATHEMATISCHE UNTERSUCHUNGEN ZUR BERECHNUNG VON STUNDENPLAENEN UND TRANSPORTFAHRPLAENEN]

Carl August Zehnder (Ph.D. Thesis) 1965 86 p refs In GERMAN

(Rept.-3723) CFSTI: $3.00

Specific assignment and planning problems are formulated and mathematically stated. Methods for solving these problems, pertinent computer programs, and results of computations are given. Several textbook methods, especially for linear optimization, are studied for applicability. Assignment processes are complemented by ALGOL programs, most of which contain complete input and output data for a CDC 1604 A computer. Problems in adapting these programs to specific situations are discussed, particularly for complex class schedules. Transl. by K.W.

N67-21760# Eidgenossische Technische Hochschule, Zürich (Switzerland).

ON THE EIGENVALUES OF SUMS OF TWO SELF-ADJOINING OPERATORS [UEBER DIE EIGENWERTE DER SUMME ZWEIER SELBSTADJUNGIERTER OPERATOREN]

Bruno Peter Zwahlen (Ph.D. Thesis) Repr. from Comment. Math. Helvet. (Zurich), v. 40, no. 2, 1966 p 5-40 refs In GERMAN

(Rept.-3543) CFSTI: HC $3.00/MF $0.65

Treated are: (1) extremum principles for sums of eigenvalues of a self-adjoining linear operator with a unitary vector space L; and (2) linear inequalities between certain eigenvalues $\alpha_\nu, \beta_\mu, \gamma_\lambda$ of two self-adjoining linear operators A, B, and their sum C = A + B. Several new results for sums of eigenvalues are derived. Considerations proceed from the tracking function of an operator. This function is defined for all linear partial spaces of L and represents a natural generalization of the Rayleigh quotient. The most important extremum principles for sums of eigenvalues are again formulated and proven; they serve in turn to analyze linear inequalities. A method for deriving additional inequalities is described. The proofs are mainly algebraic-constructive: partial spaces of L which satisfy certain conditions of orthogonality are constructed, and tracking functions are applied to these spaces. While the first part of the work is concerned with operators in a finite-dimensional vector space, later developments demonstrate the application of the results to operators in Hilbert spaces. Transl. by K.W.

N67-21765# International Centre for Theoretical Physics, Trieste (Italy).

A REFINED SOLUTION OF TWO-DIMENSIONAL MODEL THEORIES

F. Schwabl, W. Thirring, and J. Wess Aug. 1966 31 p refs Sponsored in part by U. S. Govt.

(IC/66/96) CFSTI: HC $3.00/MF $0.65

In the formulation of the model, special care was given to the definition of the current as the product of field operators. It is shown that a product of field operators, where the space-time points coincide, can be defined as the limit of products with the points separated and that the limit exists in the Borchers topology. A consistent definition of the current can be given this way, and the model where a massive vector field is coupled to this current is solved through an ansatz. The interacting fields can be expressed in terms of free canonical quantities. To avoid infrared divergences, a finite volume is used. Author (ESRO)

N67-21770# International Centre for Theoretical Physics, Trieste (Italy).

ON THE CONFORMAL GROUP ALGEBRA AND ITS UNITARY REPRESENTATION IN THE SPACE OF HARMONIC FUNCTIONS

Awele Madzuemezia Jan. 1967 28 p refs Submitted for publication

(IC/67/4) CFSTI: HC $3.00/MF $0.65

The equations establishing the group SO(4,2)—the conformal group—as the group of motions of the 5-dimensional pseudosphere are explicitly solved in spherical coordinates. The 15 most natural generators of the conformal group, in terms of which the maximal compact subgroup factors out, are thereby realized in terms of the natural coordinates of this space. In terms of these generators, the generators of the Poincare group plus dilatations are explicitly written. It is shown that the mass squared operator is not diagonal in the irreducible representation of the conformal group in the Hilbert space of harmonic functions defined on a 5-dimensional pseudosphere. The restriction of this representation to the Poincare group is therefore not irreducible. Author (ESRO)

N67-21771# International Centre for Theoretical Physics, Trieste (Italy).

EXISTENCE OF MANY-CHANNEL N/D REPRESENTATION

R. L. Warnock Jan. 1967 41 p refs Submitted for publication Sponsored in part by AEC

(IC/67/2) CFSTI: HC $3.00/MF $0.65

Existence of the N/D representation is proved for an appropriate class of scattering matrices. The proof refers to a finite number of two-body channels. Alternatively, it refers to the N/D method with absorption in which n two-body channels appear explicitly, and all other channels are taken into account by absorption parameters. The existence theorem requires asymptotic conditions on the scattering matrix weaker than those needed in earlier work on the subject. The conditions are compatible with the Regge pole model of asymptotic behavior provided the N/D method with absorption is used. An important factorization of the general D

matrix is obtained in the form D = DR where D is a certain matrix which is non-singular and free of poles at all finite points of the plane, and R is a matrix of rational functions. An analogous factorization is familiar in the single-channel problem, where D is an exponential function of a phase-shift integral. By means of the formula D = DR, generalized Levinson relations are formulated. One such relation is new; it has to do with n two-body channels, but does not involve neglect of the other channels. Author (ESRO)

N67-21799# Academia R. P. R., Bucharest. Institutul de Fizica Atomica.

REPRESENTATION OF THE INFINITESIMAL UNITARY GROUPS BY INFINITESIMAL CANONICAL TRANSFORMATIONS

S. Titeica 1965 29 p

(IFA-FT-59) CFSTI: HC $3.00/MF $0.65

The problem of the representation of any infinitesimal Lie group by infinitesimal canonical tranformations is formulated then it is solved by recurrence in the special case of the unitary groups of arbitrary dimensionality. Author (NSA)

N67-21837*# Wisconsin Univ., Madison. Mathematics Research Center.

MOMENTUM OPERATORS IN QUANTUM MECHANICS

A. M. Arthurs Jul. 1966 13 p refs

(Grant NsG-275-62; Contract DA-11-022-ORD-2059)

(NASA-CR-83247; MRC-TSR-679; AD-642903) CFSTI: HC $3.00/MF $0.65 CSCL 20J

A representation for momentum operators corresponding to real observables is obtained by using functional integration in phase space. Author (TAB)

N67-21846# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

THE DETERMINATION OF EIGEN VALUES AND EIGEN VECTORS OF A MATRIX ON A M-20 DIGITAL COMPUTER

S. Turgunov 31 Oct. 1966 8 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Otd. Tekhn. Nauk (Moscow), no. 3, 1965 p 85–87

(FTD-HT-66-553; TT-67-60686; AD-646286) CFSTI: HC $3.00/MF $0.65

A special system of linear algebraic equations of a certain form must be used to determine the frequencies and forms of free oscillations of rod systems in structural mechanics. A program for determining the eigenvalues and the eigenvectors of matrices M through iteration and exhaustion methods has been composed. With this program the eigenvalues and eigenvectors of matrices up to the 57th order where all real eigenvalues and eigenvectors are considered may be calculated, and the nonsymmetric matrices obtained in the problems of structural mechanics may be brought to symmetric matrices according to the method of operation. The computers program and operation are described with a block diagram showing the computers arrangement, and an example of the results is shown. Author (TAB)

N67-21858# Air Force Western Test Range, Vandenberg AFB, Calif.

SOLUTION OF THE RICCATI EQUATION

Alvano Dean Sep. 1966 100 p

(AFWTR-TR-66-1; AD-645254) CFSTI: HC $3.00/MF $0.65

The method described in this report is advanced as a means of solving a wide range of differential equations arising from scientific applications in the aerospace industry. The technique applied for solving these equations utilizes the principle that certain differential and difference equations may be thought of as the limiting form assumed by their auxiliary functions as their orders of approximations approach infinity. The auxiliary functions for differential or difference equations always have associated residual terms which vanish as the order of approximations grow large. An auxiliary function is chosen whose solution is always represented as a rational fraction. When the numerator and denominator of this rational fraction are infinite series, this rational fraction is the solution of the equation of interest provided the quotient is finite and non-trivial. Author (TAB)

N67-21865# Wisconsin Univ., Madison. Mathematics Research Center.

SOME NEW CRITERIA FOR CONVERGENCE OF THE METHOD OF SUCCESSIVE APPROXIMATIONS Technical Summary Report

A. E. Martynyuk Aug. 1966 16 p refs

(Contract DA-11-022-ORD-2059)

(MRC-TSR-672; TT-67-60127; AD-642901) CFSTI: HC $3.00/MF $0.65

A sufficient condition is obtained for the unique solvability of the operator equation $Au + Ku = f$ and for the convergence of the obtained successive approximations. TAB

20 METEOROLOGY

Includes climatology; weather forecasting; and visibility studies. For related information see also: 13 Geophysics; and 30 Space Sciences.

N67-20422# Miami Univ., Fla. Radar Meteorological Lab.

PROCEEDINGS OF THE 1966 ARMY CONFERENCE ON TROPICAL METEOROLOGY

Homer W. Hiser and Harold P. Gerrish Oct. 1966 203 p refs Conf. held at Miami Beach, Fla., 26–27 May 1966

(Contract DA-28-043-AMC-00443(E))

(ML-66310; Rept.-12; AD-643071) CFSTI: HC $3.00/MF $0.65

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10. KINEMATICS AND DYNAMICS OF TROPICAL PRECIPITATION G. Arnason and E. A. Newburg (Travelers Res. Center, Inc.) p 97–108 refs (See N67-20432 10-20)

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12. VERTICAL MOTION OF RAINDROPS INSIDE HURRICANE RAINBANDS AS COMPUTED FROM AIRBORNE DOPPLER WINDS T. Fujita and P. G. Black (Chicago Univ.) p 128–143 refs (See N67-20434 10-20)

13. DIURNAL CIRCULATIONS AND THEIR CLIMATIC SIGNIFICANCE IN EASTERN AFRICA H. Flohn and K. Fraedrich (Bonn Univ.) p 144–151 refs (See N67-20435 10-20)

14. DIURNAL CHANGES OF WATER VAPOR FLUX IN THE CARIBBEAN AREA W. H. Portig (Natl. Eng. Sci. Co.) p 152–161 refs (See N67-20436 10-20)

15. DIURNAL VARIATION OF RAINFALL IN EL SALVADOR, CENTRAL AMERICA H. Lessmann (Natl. Meteorol. Ser. of El Salvador) p 162–179 refs (See N67-20437 10-20)

N67-20423# Raven Industries, Inc., Sioux Falls, S. Dak.
HAIL INCIDENCE IN THE TROPICS
E. M. Frisby and H. W. Sansom (East African Meteorol. Dept.) *In* Miami Univ. Proc. of the 1966 Army Conf. on Trop. Meteorol. Oct. 1966 p 2–13 refs Prepared jointly with East African Meteorol. Dept. (See N67-20422 10-20) CFSTI: HC $3.00/MF $0.65

A summary is presented of hail incidence in tropical areas within 23-1/2° north and south of the equator, and data are graphed for various stations around the equatorial belt. Three hail regimes were distinguished. Zone 1, covering latitudes 10° to 23-1/2° north of the equator, includes areas of the Caribbean, Mexico, Central America, Africa, India, Asia, Hawaii, and the Philippines. Zone 2, latitudes 10° north to 10° south, comprises equatorial sections of South America, Africa, and Indonesia. Zone 3, latitudes 10° to 23-1/2° south of the equator, includes sections of South America, Africa, Madagascar, Northern Australia, and Polynesia. In zones 1 and 3, hail occurs principally in the spring months; and, in most instances, is a feature of the relatively dry season preceding the summer rains. In zone 1, the months are principally February to May; in zone 3, September to December. In zone 2, however, hail appears to have at least two seasons; and sometimes occurs intermittently throughout the year. M.W.R.

N67-20424# Miami Univ., Fla. Radar Meteorological Lab.
SOUTH FLORIDA'S DYNAMIC RAIN DUO
Harold P. Gerrish *In its* Proc. of the 1966 Army Conf. on Trop. Meteorol. Oct. 1966 p 14–23 refs *Its* Contrib. No. 728 (See N67-20422 10-20) CFSTI: HC $3.00/MF $0.65

Extreme weather in the tropics is usually associated with hurricanes. Such systems are usually quite large, and the observation network as well as the state of the art is such that ample warning can be given days in advance. At times, however, extreme weather occurs in these regions from other systems or interactions that are only partially understood and permit little warning, if any. Two such situations that occurred within 17 days of each other in October 1965 in essentially the same portion of South Florida are analyzed. These two events accounted for more than 40 inches of rain in the Fort Lauderdale area, with extensive flooding along the relatively flat Gold Coast of Florida. It is observed that streamline analyses and auxiliary time sections of such parameters as potential temperature, mixing ratio, precipitable water, potential vertical velocity of 500mb, divergence, and vorticity provide the best insight into the synoptic aspects of the problem. Pressure analysis was unrewarding. Author

N67-20425# Florida State Univ., Tallahassee.
ATMOSPHERIC SCALES OF MOTION AND RAINFALL DISTRIBUTION
Michael Garstang *In* Miami Univ. Proc. of the 1966 Army Conf. on Trop. Meteorol. Oct. 1966 p 24–35 ref (See N67-20422 10-20) CFSTI: HC $3.00/MF $0.65

A two-dimensional view that considers both space and time changes in rainfall distribution reinforces earlier conclusions that the greater percentage of rain is associated with organized systems in the atmosphere. Instead of previous estimates of 10% of the days accounting for between 40 to 50% of the rain, times and regions are found where 10% of the days with rain account for 70% of the total rainfall. This concentration of rain is closely linked to scales of motion in the atmosphere that can affect very large regions. Little difference is noted between single island observations and the whole area encompassing the Barbados, St. Vincent, Grenada, and Trinidad; and this is considered to suggest a difference in structure between the synoptic-scale structure that is responsible for the winter-time results shown for Florida and the organized synoptic-scale disturbance responsible for the bulk of the rain in this tropical region. It is considered possible that the structure of the rain-producing synoptic-scale system in the tropics is such that the mesoscale and convective-scale of motion are dominant. M.W.R.

N67-20426# Florida State Univ., Tallahassee.
ON THE DISTRIBUTION OF RAINFALL PROBABILITY OVER BARBADOS
N. E. Le Seur *In* Miami Univ. Proc. of the 1966 Army Conf. on Trop. Meteorol. Oct. 1966 p 36–43 refs (See N67-20422 10-20) CFSTI: HC $3.00/MF $0.65

An 11-year sample of rainfall data from 100 stations on Barbados, stratified with regard to climatic and synoptic regimes, is used to compute the spatial distribution of rainfall probability over the island. The resulting distributions show a high degree of association with the island topography. It is suggested that release and organization of convection in the form of cumulus rows or "streets" most logically explains the observed patterns. Author

N67-20427 Texas A&M Univ., College Station.
MESOSCALE RAINFALL IN THE MACROSCALE SYSTEM
W. K. Henry and J. F. Griffiths *In* Miami Univ. Proc. of the 1966 Army Conf. on Trop. Meteorol. Oct. 1966 p 44–49 (See N67-20422 10-20) CFSTI: $3.00

Examples of rainfall occurrence in southeastern Guatemala are shown and the concurrent synoptic situations are discussed. Some relationships between the macroscale and mesoscale systems are considered. It is concluded that tropical rainfall is variable; and that any attempt to analyze isohyets of daily, monthly, or yearly totals will show a great areal variation. The rainfall varies both in distance and time. Author

N67-20428# Texas A&M Univ., College Station.
A STUDY OF THE MOVEMENT OF RAIN AREAS IN CENTRAL AMERICA, TOGETHER WITH A PRELIMINARY INVESTIGATION OF WEST INDIAN RAINFALL DISTRIBUTION
John F. Griffiths *In* Miami Univ. Proc. of the 1966 Army Conf. on Trop. Meteorol. Oct. 1966 p 50–61 (See N67-20422 10-20) CFSTI: HC $3.00/MF $0.65

The technique of harmonic analysis has been applied to studying rain areas throughout Central America. This shows how the first harmonic explains most of the variance (70% or more), except on the Atlantic coast of Costa Rica and in Northwestern Panama. A study of month-to-month variation has shown the movement of certain synoptic features with which rainfall is

associated, indicating the areas in which these are most dominant during the year. A study of some long rainfall periods in Barbados and Grenada has shown how extreme falls negate the normality pattern and may be considered from a synoptically different population. Author

N67-20429# Allied Research Associates, Inc., Concord, Mass. Aracon Geophysics Div.

SPATIAL AND TEMPORAL DISTRIBUTIONS IN TERRAIN-RELATED CLOUD COVER OVER VIETNAM

Earl S. Merritt *In* Miami Univ. Proc. of the 1966 Army Conf. on Trop. Meteorol. Oct. 1966 p 62–74 ref (See N67-20422 10-20) CFSTI: HC $3.00/MF $0.65

The Viet Nam/Southeast Asia region is influenced by major monsoonal flow patterns throughout much of the year. The period from late October into April is characterized, in very general terms, by a northeast monsoonal airstream, while the period from May through September is characterized by a southwest monsoonal airstream. The transitional periods of April–May and September–October are the periods in which major tropical synoptic features, such as tropical storms or typhoons, influence the area. Thus, for better than eight months of the year, Army weather support problems are related to airstream/topography interrelationships, which are not adequately described by conventional observations. Forecasts are heavily influenced by climatology, and experience has shown that tropical weather frequently differs from climatology. Observations from meteorological satellites can provide prevailing cloud distributions. To make effective use of these observations, the significance of the observed cloud distributions for the specific wind, topography, and moisture conditions must be considered. Preliminary observations are given to show the approach in a program to investigate the Viet Nam area satellite cloud distributions. Author

N67-20430 Nigerian Meteorological Service, Lagos.

SOME PROMINENT MESO-SCALE METEOROLOGICAL PHENOMENA IN WEST AFRICA

G. O. P. Obasi *In* Miami Univ. Proc. of the 1966 Army Conf. on Trop. Meteorol. Oct. 1966 p 75–84 refs (See N67-20422 10-20) CFSTI: $3.00

Disturbance line squalls or thunderstorms, scattered and local thunderstorms, the little dry season, and the harmattan dust haze are discussed as the most prominent mesoscale meteorological phenomena in Nigeria and West Africa. Disturbance lines tracked in West Africa are tabulated by months for 1962 and 1965, and thermodynamic considerations related to these lines are discussed. Consideration is given to the perturbation of the intertropical discontinuity surface by a well developed disturbance line. Synoptic conditions that favor the occurrence of scattered thunderstorms are noted, and an upper cross section for Lagos during a severe dust haze is shown. M.W.R.

N67-20431# Saint Thomas Univ., Houston, Tex.

THE DETECTION AND A PREDICTION METHOD FOR WAVES ON A TROPICAL INVERSION

Joseph L. Goldman and John C. Freeman, Jr. *In* Miami Univ. Proc. of the 1966 Army Conf. on Trop. Meteorol. p 85–96 (See N67-20422 10-20) CFSTI: HC $3.00/MF $0.65

The lower atmosphere in the vicinity of Eniwetok in the spring of 1958 is modeled as an inversion sloping up to the north and south from a low point at about 10°N. A theory for motion of such an inversion is developed. Several waves on this inversion were detected, with continuity shown from Majouro to Truk (20° of longitude). A forecasting method for such waves is described. Author

N67-20432# Travelers Research Center, Inc., Hartford, Conn.

KINEMATICS AND DYNAMICS OF TROPICAL PRECIPITATION

G. Arnason and E. A. Newburg *In* Miami Univ. Proc. of the 1966 Army Conf. on Trop. Meteorol. Oct. 1966 p 97–108 refs (See N67-20422 10-20) CFSTI: HC $3.00/MF $0.65

The formation and dissipation of a convective roll-type cloud is simulated by means of a numerical experiment. Initially, a buoyant bubble near the lower boundary is introduced into statically stable surroundings saturated with moisture; and the equations of motion, continuity, and thermodynamics are solved numerically. The computed events show the bubble to rise, an associated toroidal circulation of a narrow intense updraft to form, and cloud to form in the area of ascending motion. Because of the stable surroundings, gravitational oscillations are set up; and the initial one-cell circulation is gradually replaced by three circulation cells, two of which rotate in the opposite sense of that of the original cell. As a result of this break-up into cells, the initial updraft weakens and gradually becomes a downdraft leading to the dissipation of the cloud. Shortcomings of the numerical scheme are discussed. Author

N67-20433 Weather Bureau, Washington, D. C. Systems Development Office.

AN EXPERIMENT IN THE USE OF THE BALANCE EQUATION IN THE TROPICS

M. A. Alaka, D. T. Rubsam, and G. E. Fisher (Inst. for Atmospheric Sci., ESSA) *In* Miami Univ. Proc. of the 1966 Army Conf. on Trop. Meteorol. Oct. 1966 p 109–127 refs (See N67-20422 10-20) CFSTI: $3.00

The balance equation was used to generate the geopotential height fields from the wind fields at 850, 500, and 200 millibars that occurred during the development of hurricane Carla in 1961. The results show that although the generated heights are consistently lower than the reported heights, the differences are within the range of instrumental errors, even at 200 mb where strong divergence occurs in connection with outflow from the storm. Comparison of the 200 mb contours generated by the balance equation with those obtained by including the divergence term shows that the latter heights exceed the former by up to 80 feet. Maximum differences are found where the highest values of the divergence occur. Author

N67-20434# Chicago Univ., Ill.

VERTICAL MOTION OF RAINDROPS INSIDE HURRICANE RAINBANDS AS COMPUTED FROM AIRBORNE DOPPLER WINDS

Tetsuya Fujita and Peter G. Black *In* Miami Univ. Proc. of the 1966 Army Conf. on Trop. Meteorol. Oct. 1966 p 128–143 refs (See N67-20422 10-20) CFSTI: HC $3.00/MF $0.65

A method of computing vertical motion of the raindrops that attenuate Doppler beams of an airborne APN 82 wind system was developed. Using data from penetrations through Hurricane Flora of October 1963, the vertical velocities of raindrops inside the eye wall and nearby rainbands were calculated. In 7 penetrations through the northwest quadrant of the eye wall, computations indicated an average downward motion of 1.5 mps. Near the inner part of the eye wall, an average value of 3 mps downward was calculated. Near the outer part of the eye wall, the mean vertical motion was zero, with maximum velocities of 15 mps downward and 15 amps upward. These measurements indicate that, in the mean, raindrops inside the eye wall are falling in the inner part of the eye wall and suspended in the outer part. Author

N67-20435# Bonn Univ. (West Germany).

DIURNAL CIRCULATIONS AND THEIR CLIMATIC SIGNIFICANCE IN EASTERN AFRICA

H. Flohn and K. Fraedrich *In* Miami Univ. Proc. of the 1966 Army Conf. on Trop. Meteorol. Oct. 1966 p 144–151 refs (See N67-20422 10-20) CFSTI: HC $3.00/MF $0.65

Divergences and convergences of the average wind field and its seasonal variations controls the average rainfall pattern in all tropical areas. Where the rainfall network is dense enough, the role of diurnal circulation and its divergence effects can be demonstrated. The occurrence of these diurnal conditions is much more regular in tropical and subtropical areas than at higher latitudes. This is attributed to the larger time and horizontal variability of net radiation and heat budget, as well as to the relative weakness of the synoptic and seasonal wind systems. Effects of these systems on climate and weather are seen at the Red Sea rift, and in northern Somalia where the sea breeze from the Gulf of Aden can block the strong and highly persistent southwest monsoon during the summer. Calculations are presented for a diurnal circulation at Lake Victoria, based on observations over a 5-year period. M.W.R.

N67-20436# National Engineering Science Co., Pasadena, Calif.
DIURNAL CHANGES OF WATER VAPOR FLUX IN THE CARIBBEAN AREA
W. H. Portig *In* Miami Univ. Proc. of the 1966 Army Conf. on Trop. Meteorol. Oct. 1966 p 152–161 refs (See N67-20422 10-20) CFSTI: HC $3.00/MF $0.65

Moisture flux data change substantially between 00Z (sunset) and 12Z (sunrise). Since the difference vectors are rather consistent over the entire Caribbean area (except for Panama) it is concluded that the changes are not produced by local influences. Four days of 3-hourly data show that the flux difference between 10Z (very early morning) and 20Z (afternoon) is much larger than that between 00Z and 12Z. Most of the total flux change is due to wind variations. The main contribution to the flux change comes from the layers near 900 mb, while surface and mid-troposphere conditions tend to decrease the diurnal variation of the total moisture flux. A future theory of the phenomenon should take into account that at latitudes smaller than 42° the diurnal temperature changes spread to the west faster than sound with 1.3 Mach over the Caribbean. Author

N67-20437# National Meteorological Service of El Salvador, San Salvador.
DIURNAL VARIATION OF RAINFALL IN EL SALVADOR, CENTRAL AMERICA
Helmut Lessmann *In* Miami Univ. Proc. of the 1966 Army Conf. on Trop. Meteorol. Oct. 1966 p 162–179 refs (See N67-20422 10-20) CFSTI: HC $3.00/MF $0.65

Mean monthly and yearly diurnal variations of rainfall were computed from 7 to 13 years records for selected locations in El Salvador. They reveal interesting dynamic climatological features of rainfall production of mesoscale and synoptic origin, such as the sea breeze front with its shower highways, orographic effects, the penetration of maritime shower activity at night into inland, and grown-old fronts and temporales advected from the Pacific Ocean area. One-third of the yearly rainfall is produced within a 3 hour interval between 17 and 21 hours local time. A considerable difference in hourly rainfall distribution between July–August and June–September–October was found. Author

N67-20500# Aeronautical Chart and Information Center, St. Louis, Mo. Linguistic Section.
BAROMETRIC LEVELING METHOD IN GRAVIMETRIC SURVEY WITH ISO-ANOMALIC LINES SEPARATED BY 0.5 AND 1.0 MGAL INTERVALS [METODIKA BAROMETRICHESKOGO NIVELIROVANIYA PRI GRAVIMETRICHESKIKH SEMKAKH S SECHENIEM IZOANOMAL CHEREZ 0.5 I 1.0 MGL]
I. N. Kulakov Nov. 1966 16 p Transl. into ENGLISH from Razved. i. Promysl. Geofiz. (Moscow), no. 7, 1965 p 107–117 (ACIC-TC-1116; TT-67-60177; AD-643485) CFSTI: HC $3.00/MF $0.65

The conclusion was drawn that obtaining the elevation marks with a mean quadratic error of plus or minus 0.5m is possible only by the method with reference to one station. For the elevation control of one-and two milligal gravimetric surveys the method with reference to one or several stations may be used. Author (TAB)

N67-20573# White Sands Missile Range, N. Mex. Atmospheric Sciences Lab.
THE TOWER SHADOW EFFECT
J. E. Cermak and J. D. Horn Aug. 1966 29 p refs (ECOM-5074; AD-642854) CFSTI: HC $3.00/MF $0.65

A practical example of obstacle-induced flow in the atmosphere that constitutes a substantial meteorological measurement problem is the wind shadow effect of a meteorological tower on wind velocity in the lee of the structure. At White Sands Missile Range, New Mexico, a 150-meter tower is utilized to obtain ballistic winds in the lower portion of the planetary boundary layer. An experiment has been conducted concerning the flow around a 1:4 scale model section of the tower in the subsonic wind tunnel at the Fluid Dynamics Laboratory, Colorado State University, Ft. Collins, Colorado. Comparison of field results and experiment suggests a maximum wind decrement of 40% in the tower wake. Author (TAB)

N67-20653# Massachusetts Inst. of Tech., Cambridge. Dept. of Meteorology.
THE ACCURACY OF MINIATURE BEAD THERMISTORS IN THE MEASUREMENT OF UPPER AIR TEMPERATURES
Donald C. Thompson 1 Oct. 1966 266 p refs (Contract AF 19(628)-4165) (AFCRL-66-773; SR-1; AD-643684) CFSTI: HC $3.00/MF $0.65

A laboratory study was made of the errors of miniature bead thermistors of 5, 10, and 15 mils nominal diameter when used for the measurement of atmospheric temperature. Although the study was primarily concerned with the errors of the thermistors when used in Meteorological rocket soundings between about 70 km and 30 km altitude the results are also valid for other applications of these thermistors to all altitudes down to sea level. Several distinct sources of error are present, and these have each been discussed and estimates of their magnitude made from laboratory tests. In general, all errors increase rapidly above about 50 km. Certain items which had not been fully considered in previous discussions of this problem have been shown to be highly significant. In particular it is found that the lead wires play an important part in determining thermistor response, particularly at high altitude, and that the temperature rise of the thermistor due to solar radiation is strongly dependent on the radiation absorbed by the lead wires as well as by the bead proper. Author (TAB)

N67-21336# White Sands Missile Range, N. Mex. Atmospheric Sciences Lab.
IMPROVED ROCKETSONDE PARACHUTE-DERIVED WIND PROFILES
Marvin Kays and R. O. Olsen Oct. 1966 29 p refs (ECOM-5085; AD-644818) CFSTI: HC $3.00/MF $0.65

A correction technique to derive a realistic wind profile from an observed parachute wind profile was developed and is being used at White Sands Missile Range, New Mexico. Wind profiles are obtained by utilizing a computer and data obtained by an FPS-16 radar which tracks the parachute and records parachute position at the rate of 10

points per second on a digital tape. To test the validity of the correction technique, several experiments were conducted in which two rockets, one containing a parachute wind sensor and the other containing special high-altitude chaff, were fired within a time period of five minutes. The corrections were applied to the parachute-determined winds and the resulting wind profiles compared with the chaff-determined wind profiles. In extreme cases, the correction can amount to 200 meters per second. Author (TAB)

N67-21436# Federal Aviation Agency, Atlantic City, N. J. Test and Evaluation Div.

A STUDY OF RADAR METEOROLOGICAL FINDINGS RELATED TO RADAR WEATHER DETECTION AND AIR TRAFFIC CONTROL Final Report

Robert J. Sause Oct. 1966 75 p refs

(SRDS-RD-66-65; AD-643258) CFSTI: HC $3.00/MF $0.65

A study was conducted which encompassed a review of fundamentals and progress to date in the field of radar meteorology. The basic purpose of the study was the correlation of the findings of known authorities relative to the classification of radar reflectivity as a function of weather phenomena and the operational significance of these characteristics to aviation and air traffic control. It was concluded that the general classification of radar reflectivity as a function of weather phenomena provides a useful measure of relationship between reflectivity levels and associated degrees of turbulence. Recommendations included the continuation of Federal Aviation Agency-supported programs and the development of systems to eliminate weather clutter from displays by substitution of controlled contour outlines. Author (TAB)

N67-21447*# Honeywell, Inc., Minneapolis, Minn.

DERIVATION OF A METEOROLOGICAL BODY OF DATA COVERING THE NORTHERN HEMISPHERE IN THE LONGITUDE REGION BETWEEN 60°W AND 160°W FROM MARCH 1964 THROUGH FEBRUARY 1965

Roy E. Peterson, John Schuetz, William E. Shenk, and Wen Tang (GCA Corp.) Wasington, NASA, Apr. 1967 183 p refs

(Contract NAS1-6010)

(NASA-CR-723) CFSTI: HC $3.00/MF $0.65 CSCL 04B

Identification and analysis has been made of implicit factors between 0–90 km which may cause significant change in the magnitude and shape of the Earth's horizon radiance profile in the 15 micron carbon dioxide absorption band. The implicit factors considered include: (1) horizontal and vertical variability of temperature and pressure, (2) seasonal, synoptic, interdiurnal and diurnal variability of temperature and pressure, (3) variability of CO_2 concentration, (4) variability of high cloud occurrence, and (5) miscellaneous factors such as topological features. Major emphasis was placed on the study of spatial and temporal variability of temperature. A primary set of 1039 interpolated sounding profiles was determined for the following basic categories of temperature (and pressure) variability: (1) large-scale synoptic variability at 56 grid points over North America, (2) small-scale spatial variability at 100-km intervals along a 5600-km long space cross section, (3) small-scale temporal variability at three different locations, (4) temporal variability at a northern latitude station during a select case of true stratospheric warming, and (5) large-scale climatological variability at 50 grid points over North America. In addition, a set of 46 auxiliary profiles was developed for different locations and/or time periods not covered by the primary set. Author

N67-21703# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

INSPECTION OF A METEOROLOGICAL NETWORK

D. F. Nezdyurov 6 Jun. 1966 365 p refs Transl. into ENGLISH of the book "Inspektsiya Meteorologicheskoy Seti" Leningrad, Gidrometeorol. Izd., 1955 p 1–316

(FTD-MT-65-230; TT-67-60325; AD-644111) CFSTI: HC $3.00/MF $0.65

The book is an aid in which the organizational methods and procedures of hydrometeorologic stations and posts are systematized, and procedures for checking the performance of basic meteorological observations and the operational service of various areas of the national economy are outlined. It gives brief instructions for checking additional hydrometeorologic observations, e.g., aerologic, actinometric, and agrometeorologic, in enough detail, necessary for an inspector of the hydrometeorological service. There is a brief reference section on the tasks that an inspector must perform at hydrometeorological stations, and information that is necessary for carrying out urgent repair of instruments and equipment. Author (TAB)

N67-21869# Hawaii Inst. of Geophysics, Honolulu.

LAGRANGIAN DYNAMICS AND LOW LATITUDE WEATHER

A. H. Gordon and R. C. Taylor 3 Aug. 1966 34 p refs

(Contracts AF 19(628)-3860; Grant NSF GA-386)

(HIG-66-12; Rept.-1; AD-644022) CFSTI: HC $3.00/MF $0.65

The differential equations of horizontal motion of the atmosphere with variable Coriolis parameter have been integrated numerically for both frictionless flow and flow which incorporates a coefficient of surface frictional resistance, to obtain trajectories of air parcels which move through observed meridional pressure gradient profiles within the tropics. Convergence patterns have been computed from the trajectories of adjacent air parcels which are initially at a fixed distance apart. Good agreement has been obtained between the convergence computed by following the flow and the rainfall and cloudiness observed by satellites and surface weather observations for case examples on both synoptic and climatological time scales in the South Central Pacific and the Indian Ocean. TAB

21 NAVIGATION

Includes guidance; autopilots; star and planet tracking; inertial platforms; and air traffic control. For related information see also: 07 Communications.

N67-20531 Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

CENTRAL NAVAL SCIENTIFIC-RESEARCH INSTITUTE Selected Articles

8 Aug. 1966 28 p refs Transl. into ENGLISH from Tsentr. Nauchn.-Issled. Inst. Morskogo Flota. Inform. Sb. (Leningrad), Issue 79, 1962 p 31–39; p 56–63

(FTD-MT-65-35; TT-67-60272; AD-64394) CFSTI: $3.00

CONTENTS:

1. PILOT IDENTIFICATION INSTRUMENTS R. P.Bibichkova and R. P. Dmitriyev p 1–12 refs (See N67-20532 10-21)

2. THE EFFECT OF SEA ROUGHNESS ON RADAR VISIBILITY OF SMALL SHIPS I. D. Demin p 13–21 refs (See N67-20533 10-21)

N67-20532 Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

PILOT IDENTIFICATION INSTRUMENTS

R. P. Bibichkova and R. P. Dmitriyev *In its* Central Naval Sci.-Res. Inst. (Selected Articles) 8 Aug. 1966 p 1–12 refs (See N67-20531 10-21) CFSTI: $3.00

Pilot identification instruments responding in the ultrashort wave range and in the harbor radar frequency range for identification

of ships from shore are briefly described. The broadband receiver to be used with the portable ultrashort wave instrument is also described, and the deficiencies of the system are stated as the short range of operation, the dependence of the operation instrument on other systems, and great magnitude of signal delay. The basic technical parameters and the circuitry are given for the instrument with harbor radar frequency response. Although larger and heavier, this identification instrument is free from the above mentioned deficiencies. N.E.N.

N67-20533 Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE EFFECT OF SEA ROUGHNESS ON RADAR VISIBILITY OF SMALL SHIPS
I. D. Demin *In its* Central Naval Sci.-Res. Inst. (Selected Articles) 8 Aug. 1966 p 13–21 refs (See N67-20531 10-21) CFSTI: $3.00

Research on means to decrease radar interference due to rough seas is reviewed, emphasizing the dispersion coefficient and factors which influence it. The dispersion coefficient is discussed in terms of the angle of slip, frequency and polarization of the electromagnetic radiation, and the height and direction of the sea waves. The addition of simple corner reflectors was found to increase the power of the useful signal, and promoted detection of small ships during moderate roughness. A model automatic radar beacon-responder was tested, and it was determined that the free-space range of small ships was increased up to 13–14 miles. N.E.N.

N67-21370# Naval Research Lab., Washington, D. C.
THE ALTITUDE RATE COMMAND SYSTEM
Barbour Lee Perry and H. P. Birmingham 27 Oct. 1966 14 p refs
(NRL-6459; AD-644477) CFSTI: HC $3.00/MF $0.65

A visual landing aid designed to increase landing accuracy and thus reduce accident rates, has been developed. Called the Altitude Rate Command (ARC) system, it provides highly sensitive rate-of-descent error information to approaching aircraft. The information is encoded as a cyclic sequencing of the intensity of a single light. The pilot interprets a repetitive increasing of intensity as a command to increase power so as to decrease his sink rate. Conversely, a decreasing sequence indicates the need to reduce power in order to increase rate of descent. In addition, binary hi-lo information is provided by color coding of the sequencing light: amber signifies on glide path, green signifies high, and red warns of the potentially dangerous low condition. The introduction of intensity sequencing, rather than the color sequencing of the similar Rainbow Optical Landing System, to encode error rate permits increased information rate and minimum interpretation time, which thus increase the effectiveness of the rate display. Author (TAB)

N67-21867# Lincoln Lab., Mass. Inst. of Tech., Lexington.
NAVIGATION WITH HIGH-ALTITUDE SATELLITES: A STUDY OF RANGING ERRORS Technical Note
T. J. Goblick 26 Aug. 1966 41 p refs
(Contract AF 19(628)-5167)
(TN-1966-46; ESD-TR-66-418; AD-643851) CFSTI: HC $3.00/MF $0.65

In order to determine the position of a receiver on earth to within a fraction of a mile using high-altitude satellites, 10-meter accuracy in the receiver-satellite ranges or range differences is necessary. The factors that affect ranging systems attempting to achieve such accuracies are considered here rather than the detailed design of a ranging system. It is concluded that the effects of multipath propagation on ranging accuracy for receivers in aircraft must be experimentally studied prior to any judgment of the feasibility of such accuracies. In the absence of multipath, the satellite power and bandwidth requirements and ionospheric and tropospheric effects do not prohibit 10-meter range accuracy. Author (TAB)

22 NUCLEAR ENGINEERING

Includes nuclear reactors and nuclear heat sources used for propulsion and auxiliary power. For basic research see: 24 Physics, Atomic, Molecular, and Nuclear. For related information see also: 03 Auxiliary Systems; and 28 Propulsion Systems.

N67-20702# Los Alamos Scientific Lab., N. Mex.
FEASIBILITY STUDY FOR FABRICATION OF Cu-B_4C SHEET
R. W. Keil, R. E. Riley, and H. Sheinberg 21 Oct. 1966 89 p refs
(Contract W-7405-ENG-36)
(LA-3570-MS) CFSTI: HC $3.00/MF $0.65

The use of Cu-B_4C control plates to replace the Al-B^{10} plates used in the Kiwi reactors was established by an extensive program involving mechanical testing, metallographic and chemical analysis, and neutron absorption and thermal expansion studies. The feasibility studies showed that Cu sheet 0.100 in. thick loaded with 21.9 w/o B_4C could be rolled and was equivalent to the former Al-20 w/o B^{10} control plates. These studies and the process development required to produce the Cu-B_4C sheet were carried out on plates 2.0 in. by 2.0 in. of varying thickness. The process was then scaled-up to the production requirements of 0.100 in. thick sheet hot rolled from 14.75 in. by 5.75 in. by 0.42 in. hot pressed plates. Author

N67-20739*# Westinghouse Electric Corp., Pittsburgh, Pa. Astronuclear Lab.
DESIGN AND DEVELOPMENT OF THE "ALL-WELDED-AND-BRAZED" INSTRUMENTATION PORTS FOR NERVA REACTORS
W. Kavalkovich [1966] 18 p ref
(Contract SNP-1)
(NASA-CR-83200; WANL-TME-1465) CFSTI: HC $3.00/MF $0.65 CSCL 21F

The design and development of all-welded-and-brazed instrumentation ports for NERVA reactors are discussed. The instrumentation ports permit passage of bundles of instrumentation leads through the pressure vessel wall. Brazing and welding processes are utilized in the port assembly to provide a leak-tight seal between the stainless steel-sheathed instrumentation leads and the reactor's Al pressure vessel. Comprehensive testing demonstrated that the subject assembly remains leak tight (leakage rate les than 10^{-8} standard cc H_2/sec) through resonant vibrations, hydraulic and structural shock loads and during extreme thermal cycles. Author (NSA)

N67-20745# Battelle-Northwest, Richland, Wash.
A MODEL SAFEGUARDS LABORATORY–AN APPENDIX TO BNWL-301: APPLICATION OF SAFEGUARDS TO NUCLEAR FUEL PROCESSING PLANTS
D. P. Granquist and R. A. Schneider Sep. 1966 10 p refs
(Contract AT(45-1)-1830)
(BNWL-301, Append.) CFSTI: HC $3.00/MF $0.65

In order to present a realistic appraisal that includes specific details on the number of personnel, equipment, and tasks to be performed by an inspection team, a particular set of conditions to exemplify the problems involved was selected. A safeguards

laboratory that is assumed to be an integral (yet independent) part of a separations plant processing 100 to 200 tons of uranium per year is portrayed. NSA

N67-20762# Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.

CONTRIBUTION TO THE STUDY OF THE TEXTURES OF URANIUM RODS PREPARED BY SINTERING-EXTRUSION, AND THEIR CONSEQUENCES ON THE THERMAL CYCLING BEHAVIOR [CONTRIBUTION AL'ETUDE DES TEXTURES DE BARREUX D'URANIUM MIS EN FORME PAR FRITTAGE-EXTRUSION ET LEURS CONSEQUENCES SUR LE COMPORTEMENT AU CYCLAGE THERMIQUE]

Jose Peix (Ph.D. Thesis—Paris Univ., Orsay, France) 1966 73 p refs In FRENCH

(CEA-R-2972)

U rods prepared by sintering-extrusion in the α or β phase using slightly oxidized powders were subjected to thermal cycling. At the same time, dilatometric and X-ray techniques made it possible to determine the structures produced in these materials during their fabrication. A relationship is proposed linking the texture to the increase in length on thermal cycling. Sintered-extruded rods in the β phase at a low density with large grain-size and no preferential texture were studied along with sintered-extruded rods in the α phase at high density with fine grain and pronounced preferential texture. After 1000 thermal cycles between 20 and 550°C, the length increases were 2% for a U sintered-extruded in the β phase and between 14 and 56% according to the extrusion ratio for the U sintered-extruded in the α phase. In the case of rods sintered-extruded in the α phase, determination of the case of rods sintered-extruded in the α phase, determination of the pole figure using the Schulz reflection method showed the existence of two preferential orientations parallel to the direction of extrusion: one close to [100], and the other close to [110]. By dilatometry it was then possible to measure quantitatively the proportion of each constituent in the overall texture and to show that an increase in the percentage of [100] occurs with increasing amounts of cold-working. The increases in length owing to thermal cycling are connected to the percentage amounts of each component. It seems that the increases in length diminish as the percentage of [100] increases. On the other hand the behavior of materials containing large amount of [110] is still far from clear. Author (NSA)

N67-20775# General Electric Co., San Jose, Calif. Atomic Power Equipment Dept.

FISSION FRAGMENT DAMAGE TO TYPE-304 STAINLESS STEEL FUEL CLADDING

H. S. Rosenbaum, J. S. Armijo, and U. E. Wolff Jan. 1966 33 p refs

(Contract AT(04-3)-361)

(GEAP-5002) CFSTI: HC $3.00/MF $0.65

During the examination of irradiated cladding from experimental fuel rods, the inner surface of the type-304 stainless steel cladding was found to have a duplex-layered structure 5 to 10 μ thick. This structure is within the range of recoiling fission fragments and is believed to be a fission-damaged zone. Examination of the zone by metallography, electron microscopy, and with colloidal magnetite showed that both layers of the duplex structure are austenitic and have the same crystallographic orientation as the underlying austenitic matrix. Both layers are harder than the underlying matrix, yet they are readily distinguished by their different etching characteristics. Possible reasons for the existence of the duplex, rather than a single layer, are discussed. Author (NSA)

N67-20783# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy.

DETERMINATION OF THE DIRECTION OF THE NEUTRAL HIGH-ENERGY PARTICLE BEAM OF THE JINR SYNCHROPHASOTRON BY CONVERSION PAIRS AND γ-QUANTUM SPECTRUM IN THIS BEAM [OPREDELENIE NAPRAVLENIYA PUCHKA NEITRAL'NYKH CHASTITS VYSOKOI ENERGII SINKHROFAZOTRONA OIYAI PO IZUCHENIYU KONVERSIONNYKH PAR I SPEKTR γ-KVANTOV V ETOM PUCHKE]

T. Beshliu, V. Vishnevskii, M. Gavrilash, A. Konstantinesku, A. Mikhul et al 1966 9 p refs In RUSSIAN

(JINR-P-2916)

The direction of the JINR synchrophasotron neutral particle beam in the bubble chamber was determined by conversion pairs. The accuracy of the beam axis is determined to be about $0.6 \cdot 10^{-3}$ rad. Author (NSA)

N67-20819# General Dynamics Corp., San Diego, Calif. John Jay Hopkins Lab. for Pure and Applied Science.

ADVANCED BeO FUEL STUDIES

R. A. Meyer, F. H. Loffhus, and A. J. Goodjohn 23 Sep. 1966 22 p refs Presented at the AIME Nucl. Met. Symp. on High Temp. Nucl. Fuels, Delavan, Wis., 3–5 Oct. 1966 Submitted for publication

(Contract AT(04-3)-187)

(GA-7120; CONF-661003-7) CFSTI: HC $3.00/MF $0.65

A program was undertaken to investigate various methods of fabricating pellets of BeO containing up to 25 Vol % of U or U–Th fuel particles so the fuel would have good fission product retention characteristics up to 1650°C and linear heating rates up to 300 W/cm($\approx$20,000 BTU/hrft). The fuel pellets were fabricated by isostatically cold pressing and sintering or by hot pressing methods. In some cases the BeO matrix densities were in excess of 99.4% of theoretical and the beginning of life fractional release values for Xe and Kr were as low as 7×10^{-8} after 1 hr. The irradiation characteristics of these fuels and factors affecting the fission product retention characteristics are discussed. Author (NSA)

N67-20823# General Dynamics Corp., San Diego, Calif. John Jay Hopkins Lab. for Pure and Applied Science.

NONLINEAR ANALYSES OF XENON STABILITY IN HIGH TEMPERATURE GAS-COOLED REACTORS

R. C. Dahlberg and D. Mangan 26 Jan. 1966 24 p refs

(Contract AT(04-3)-167)

(GAMD-6924) CFSTI: HC $3.00/MF $0.65

Results are presented for nonlinear xenon stability analyses in a 1000 MW(e) HTGR and the effect of fuel zoning on the axial stability of a 330 MW(e) HTGR. Calculations were performed with GAZED, a one-dimensional depletion program. The sensitivity of the instability to core size and power density and the effect of power coefficient feedback on the instability are examined. Axial zoning of the type considered for some advanced HTGR designs is also considered. NSA

N67-20841# United Nuclear Corp., Elmsford, N. Y. Research and Engineering Center.

PERFORMANCE EVALUATION OF HEAT EXCHANGERS FOR SODIUM-COOLED REACTORS Quarterly Technical Progress Report, 1 Jul.–30 Sep. 1966

R. H. Dischinger 20 Oct. 1966 28 p refs

(Contract AT(11-1)-1452)

(UNC-5162) CFSTI: HC $3.00/MF $0.65

The evaluation of the thermal-hydraulic and structural performance of heat exchangers for Na-cooled reactor plants was

continued. The evaluation will be based on the results of tests of model heat exchangers [approximately 30 MW(t)] in the Sodium Components Test Installation (SCTI). An intermediate heat exchanger design and manufactured by ALCO Products, Inc., and a steam generator designed by ALCO Products, Inc. and manufactured by Baldwin–Lima–Hamilton Corporation are the first units to be tested. The Babcock and Wilcox (B and W) steam generator is to be tested next. Operation of the computer program for the ALCO heat exchangers, using plant shakedown data, was found satisfactory. Minor modifications are being made to the computer output format to assist evaluation. Recommendations were made regarding further steps to be taken to ascertain the severity of tube vibrations in the ALCO units. Review of heat exchanger test specifications were completed and most of the comments were resolved with the test operator. Familiarization with the B and W steam generator continued. Installation of thermocouples in the superheater bundle was witnessed. Areas for which structural evaluation procedures will be prepared have been established. Author (NSA)

N67-20843# General Electric Co., Pleasanton, Calif. Nuclear Technology Dept.

URANIUM OXIDE FUEL FOR THERMIONIC ENERGY CONVERSION

L. N. Grossman [1966] 24 p refs Presented at the AIME Conf. on High Temp. Nucl. Fuels, Delavan, Wis., 3–5 Oct. 1966

(Contract AT(04-3)-189)

(CONF-661003-9) CFSTI: HC $3.00/MF $0.65

Nuclear thermionic fuel elements that use UO_2 fuel clad with refractory metal emitters operate at high temperatures for long periods of time. Hyperstoichiometric UO_2 loses O_2 as $UO_3(g)$ when free evaporation is allowed. When tightly clad in W, small amounts of excess O_2 in the UO_2 escape the W as $O_2(g)$. When sufficient excess O_2 is present (O-to-U ratios greater than about 2.01), gaseous W (or Mo) oxides escape the cladding surface. Stoichiometric UO_2 evaporates principally as $UO_2(g)$. Stoichiometric urania clad in W loses O_2 at high temperatures by diffusion through the cladding and evaporation of $O_2(g)$. The evaporation of UO_2 at 1700 and 1900°C into a semi-infinite volume is suppressed by a factor of about 100 by Cs gas at 4 torr. The evaporation rate of UO_2 also has been observed to the suppressed by Ar cover gas at 10 torr and 1750°C with a cold collector 0.050 in. UO_2at 1600 to 2200°C (for W), and 1450 to 1750°C (for Mo) revealed a small enhancement of U flux through the cladding after cycling. The observed U flux through W and Mo is typically about 10^{-10} gm-hr^{-1}–1=cm^{-2}. Various filter and adsorbent materials were examined for possible use in the removal of oil mists and hydrocarbon vapors. A controlled flow of oil was injected into a heated nickel reaction vessel to cause vaporization and some cracking of the oil. Helium flowing through the reaction vessel carried the oil mist and hydrocarbon vapor through a filter system. Filter effectiveness was determined by the use of a Perkin–Elmer Hydrocarbon Detector, gravimetric analysis, and gas chromatographic analysis. Good removal of mists was achieved by the use of a combination of felted metal fibers and ceramic fibers in a configuration proposed for use in the MSRE. Granulated charcoal removal hydrocarbon vapors (C_6 and above) in a manner consistent with the established adsorption isotherms for this material. Author (NSA)

N67-20844# Oak Ridge National Lab., Tenn.

TESTS OF VARIOUS PARTICLE FILTERS FOR REMOVAL OF OIL MISTS AND HYDROCARBON VAPOR

B. F. Hitch, R. G. Ross, and H. F. McDuffie 7 Sep. 1966 26 p

(Contract W-7405-ENG-26)

(ORNL-TM-1623) CFSTI: HC $3.00/MF $0.65

Various filter and adsorbent materials were examined for possible use in the removal of oil mists and hydrocarbon vapors. A controlled flow of oil was injected into a heated nickel reaction vessel to cause vaporization and some cracking of the oil. Helium flowing through the reaction vessel carried the oil mist and hydrocarbon vapor through a filter system. Filter effectiveness was determined by the use of a Perkin–Elmer Hydrocarbon Detector, gravimetric analysis, and gas chromatographic analysis. Good removal of mists was achieved by the use of a combination of felted metal fibers and ceramic fibers in a configuration proposed for use in the MSRE. Granulated charcoal removed hydrocarbon vapors (C_6 and above) in a manner consistent with the established adsorption isotherms for this material. Author (NSA)

N67-20846# Phillips Petroleum Co., Idaho Falls, Idaho. Atomic Energy Div.

NUCLEAR TECHNOLOGY BRANCHES Quarterly Report, 1 Jan.–31 Mar. 1966

E. E. Burdick et al Aug. 1966 53 p refs

(Contract AT(10-1)-205)

(IDO-17192) CFSTI: HC $3.00/MF $0.65

The power distribution was measured in the ATR 39-kg core in a nominal 50–50–50 power split in the ATRC. Thermal flux and fission rate data were obtained in experiment irradiation holes. Extrapolated hot-spot power generation would be 26.2 Mw/kg at 250 Mw. Reactivity worths and calibration curves of outer shims and regulating rods in this core are presented. Be irradiated at 600°C to exposures of approximately 1×10^{21}n/cm^2>1 Mev was compression tested, and the He gas release was measured. The failure mechanism was noted, and electron fractographs of the gas bubble formation are given. The procedures used for the preparation of Resonance Integral Measurement Samples are described. These involve the use of power metallurgical techniques to produce tubular specimens containing rare earth oxides dispersed in Al. Electroless Ni–coated 6061 Al samples were corrosion tested in a pressurized water loop at 190°C and 45 ft/sec. Various heat treatments were studied. The best corrosion resistance was produced by a 54-hour, 410°C air heat treatment. Results of analysis of the structural behavior of the ATR fuel element from the thermal differences present during operation are described. Selective loading of the fuel in ATR fuel elements to decrease the beginning-of-life temperatures is examined. The results of the thermal and structural calculations for one radially variable fuel element are compared to the reference design. The energy of the hydrogen-neutron-capture gamma ray was measured, using a Li-drifted Ge detector, to be 2223.29±0.07 keV. Based upon this result, the binding energy of the deuteron was determined to be 2224.61±0.07 keV. The energy levels in ^{149}Sm were studied by means of the radioactive decay of ^{149}Pm and ^{149}Eu. Gamma-ray and conversion-electron spectra were obtained along with gamma-gamma coincidence spectra. All 29 gamma-ray transitions observed in these two activities were placed in schemes with levels in ^{149}Sm at 22.5, 277.0, 285.9, 350.0, 528.5, 558.4, 590.9, 636.4, 830.4, 833.2, and 881.9 keV. Author (NSA)

N67-20851# Atomics International, Canoga Park, Calif.

SNAP 10A SYSTEM OPTIMIZATION

P. L. Soske, ed. 1 Aug. 1966 247 p refs

(Contract AT(11-1)-GEN-8)

(NAA-SR-11935) CFSTI: HC $3.00/MF $0.65

Since the configuration of the SNAPSHOT-1 system was established, many technological advances have been made in related programs. These programs include the SNAP 2 and SNAP 8 Reactor Development Programs, the SNAP Reactor Improvement Program, and the Advanced Thermoelectric Development Program. These advances in the technology and the results of the experience gained in the SNAP 10A Program are reviewed and their applications projected to SNAP 10A and 10A-type direct radiating thermoelectric power systems. This report presents these applications to the existing SNAPSHOT-1 spare system and to new systems using newly developed high-temperature thermoelectric

converter components coupled with the existing SNAPSHOT-1 spare system; design of an optimized SNAP 10-A-type system; and design of an advanced direct radiating thermoelectric system employing both the advanced thermoelectric and reactor components. Author (NSA)

N67-20855# Commissariat a l'Energie Atomique, Fontenay-aux-Roses (France). Service d'Etudes de Protections de Piles.

FAST NEUTRON FLUX IN HEAVY WATER REACTORS [FLUX DE NEUTRONS RAPIDES DANS LES PILES A EAU LOURDE]

Jacques Brisbois and Shlomo L. Katz Jul. 1966 45 p refs In FRENCH

(CEA-R-3048)

The possibility of calculating the fast neutron flux in a natural uranium–heavy water lattice by superposition of the individual contributions of the different fuel elements was verified using a monodimensional Monte Carlo code. The results obtained are in good agreement with experimental measurements done in the core and reflector of the reactor AQUILON. Author (NSA)

N67-20856# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.

FAST FLUX TEST REACTOR: CRITICAL EXPERIMENTS PROGRAM

R. A. Bennett, P. L. Hofmann, W. W. Little, and L. L. Maas 22 Sep. 1966 29 p refs Presented at the Intern. Conf. on Fast Critical Expt. and Their Analysis, Argonne, Ill., 10–13 Oct. 1966 Submitted for publication

(Contract AT(45-1)-1830)

(BNWL-SA-909; CONF-661019-3) CFSTI: HC $3.00/MF $0.65

The purpose of the high-intensity Fast Flux Test Facility (FFTF) is to provided irradiation testing to support fuel and material development for the fast breeder power reactors. The high-intensity Fast Flux Test Facility and the Fast Test Reactor (FTR) are being designed. The complexity of the facility and the difficulties and costliness of late design changes make it necessary to assure a sound basis for nuclear design. The phases of the program are scoping of critical experiment program, planning, and performance and analysis of critical experiments. The results of the scoping effort are presented. NSA

N67-20864# IIT Research Inst., Chicago, Ill.

STUDIES OF REACTOR CONTAINMENT Bimonthly Progress Report, 1 Jun.–31 Jul. 1966

E. V. Gallagher 31 Jul. 1966 22 p refs

(Contract A(11-1)-578)

(IITRI-578P21-21; IITRI-T6042-21) CFSTI: HC $3.00/MF $0.65

A progress report is presented on the development of criteria for assessing the safety of nuclear reactors in the event of a malfunction of the reactor system. It covers problems on the generation of transient loads on containment structures in the event of a violent system excurison or a loss-of-coolant accident, and on the transmission and attenuation of disturbances through configuration of material surrounding the source. NSA

N67-20869# Phillips Petroleum Co., Idaho Falls, Idaho.

SPERT PROJECT Quarterly Technical Report, Jan.–Mar. 1966

R. M. Potenza, ed. Sep. 1966 72 p refs

(Contract AT(10-1)-205)

(IDO-17206) CFSTI: HC $3.00/MF $0.65

Loading of a slightly enriched oxide core, the E-core, in the Spert III facility was completed. Measurements were made on the E-core control rod and transient rod reactivity worths and the reactivity worth of fuel assemblies in several core positions. The E-core temperature and pressure coefficients of reactivity were independently measured as functions of system temperature. Short-period power transient tests were performed with encapsulated test space. Two fuel types were irradiated: lead rods that are normal 3%-enriched CDC fuel rods, and 4%-enriched Spert I oxide core fuel rods containing purposely induced cladding defects and known amounts of water. Fuel rod failures occurred during each of the tests. The reduced prompt neutron generation time was determined using the CDC transient test. Out-of-pile experiments were conducted with scaled mockups of the Power Burst Facility (PBF) in-pile-tube (IPT) and acoustic filter system. Different types of chemical explosives were detonated within the IPT and associated acoustic filter to generate a wide range of pressure pulse magnitudes and durations. Pressure and strain measurements were used to determine the system attenuation capabilities and preferred acoustic filter design. NSA

N67-20871# Battelle Memorial Inst., Columbus, Ohio.

DEVELOPMENT OF A FUEL SYSTEM FOR A FAST-FLUX PULSE REACTOR Summary Report

Martin S. Farkas, Robert F. Redmond, and Donald L. Keller 29 Jun. 1966 41 p

(Contract W-7405-ENG-92)

(BMI-X-10170) CFSTI: HC $3.00/MF $0.65

Potential fuel materials were identified for a pulse reactor which will provide a fast flux of 10^{16} nvt in a few milliseconds. Available data regarding the physical, thermal, and chemical properties, and compatibility behavior of fuel and cladding materials which conceivably might be suitable for pulse reactors were compiled. Chief emphasis was put on thermal properties and also on potential compatibility problems when claddings were indicated. The work was carried out in close coordination with reactor physics studies. Data for materials potentially applicable to the five pulse-reactor fuel-system concepts jointly evolved were collected and analyzed. The five reactor fuel-system concepts considered in the analyses were alloy, dispersion, ceramic, graphite, and molten salt. Potential reactor physics feasibility for all five systems was demonstrated in preliminary calculations. Nb-base–U alloys were selected as the fuel for the alloy concept, while UF_4–73 m/o LiF appears to be the only candidate for the molten-salt concept. It was concluded that the Available information could not support selection of single fual systems for the dispersion, ceramic, and graphite concepts. The primary candidates for these systems are, respectively, Nb–UO_2 and W–UO_2 dispersions, UO_2 and UO_2–BeO, and coated UO_2 particles in graphite and UC_2 particles in graphite. Author

N67-20875# Atomics International, Canoga Park, Calif.

THERMAL ANALYSIS OF SNAP-10A REACTOR CORE DURING ATMOSPHERIC REENTRY AND RESULTING CORE DISINTEGRATION AND FUEL ELEMENT SEPARATION

Edward M. Mouradian 16 Feb. 1966 154 p refs *Its* Thermo-Phys. Tech. Note No. 60

(Contract AT(11-1)-GEN-8)

(NAA-SR-MEMO-11847) CFSTI: HC $3.00/MF $0.65

A thermal analysis is carried out to determine the temperature distribution throughout a SNAP 10A reactor core, particularly in the vicinity of the grid plates, during atmospheric reentry. The transient temperature distribution of the grid plate indicates when sufficient melting occurs so that fuel elements are free to be released and continue their descent individually. The flight trajectories and heating functions are discussed. Among the topics considered are the aerodynamic drag coefficients for different flight orientations, aerodynamic heating functions, and reentry flight trajectory parameters. The local effect of the fuel element pins on the temperature distribution in the grid plate is discussed. The temperature distributions in the reactor core grid plates during

reentry are given. The applicability of the results to different flight trajectories is also considered. The thermal models developed to investigate the above problems are used with the TAP-3 (Thermal Analyzer Program) computer code. Flight trajectory calculations are carried out by means of the RESTORE (Reentering SNAP Trajectory on an Oblate Rotating Earth) computer code. Author (NSA)

N67-20891# Atomic Energy of Canada, Ltd., Chalk River (Ontario).
GRAPHS AND TABLES OF THE ISOTOPIC COMPOSITION OF PLUTONIUM PRODUCED IN CANADIAN D_2O COOLED AND MODERATED REACTORS
M. J. Halsall Oct. 1966 28 p
(AECL-2631; CRRP-1245) Available from Atomic Energy of Canada, Ltd., Chalk River: $1.00

The isotopic composition of natural uranium fuel irradiated to 10,000 MWd/t has been calculated at intervals of 500 MWd/t for three reactors—NPD, CANDU–PHW and Pickering. Three sets of results are tabulated for each reactor. These correspond to operation at the design lattice pitch and also at pitches chosen to reduce and increase the volume of moderator by 20%. Only the normal lattice pitch results are given graphically as the differences with changing pitch tend to be rather small. Author (NSA)

N67-20892# European Atomic Energy Community, Ispra (Italy).
THE HEAVY WATER REACTORS: PRESENT STATUS AND PROSPECTS [LES REACTEURS A EAU LOURDE: BILAN ET PERSPECTIVES]
A. Bahbout and J. C. Leny 1966 42 p refs Presented at Intern. Study Days on Modern Elec. Power Stations, Liege, 23–27 May 1966 In FRENCH
(EUR-2966.f; CONF-660552-1)

The advantages of this family of reactors, from the economic, political, and long-term nuclear planning points of view are recalled. A brief description is given of the main version developed in Europe, of the pressure-vessel type (MZFR, MARVIKEN) as well as of the pressure-tube type (EL-4, SGWR, ORGEL, etc...). The performance of these reactor types, in terms of fuel burnup, specific heavy water investment, and steam conditions at the inlet to the turbine, are discussed. The main problems relative to each of these reactor types are pointed out as well, with the solutions proposed by their promoters. As to the prospects of future development, first those common to this entire family of reactors are presented, such as increase of the installed power of the plant, reduction of the production cost of heavy water and of the indirect charges, enrichment, etc. The development lines specific to each group of reactor types are thereafter commented; the groups are classified according to the nature of the coolant. Author (NSA)

N67-20910# Brookhaven National Lab., Upton, N. Y.
STUDIES ON A FUEL FOR AN ORDERED BED REACTOR
G. P. Pancer, R. B. Holden, and D. H. Gurinsky [1963] 22 p refs Presented at the AIME Nucl. Met. Symp. on High Temp. Nucl. Fuels, Delevan, Wis.
(Contract AT(30-2)-GEN-16)
(BNL-10521; CONF-661003-5) CFSTI: HC $3.00/MF $0.65

The irradiation behavior of a low density (85% T.D.) UO_2–SS cermet fuel for the fast breeder reactor concept was investigated. The effects of thermal stress and burnup were determined at burnups as high as 3.8% and thermal stresses as high as 37,000 psi. No cracking and only small dimensional changes were noted in the irradiated fuel pellets. Author (NSA)

N67-20915# Atomics International, Canoga Park, Calif.
THREE-DIMENSIONAL TRANSIENT THERMAL MODEL OF A SNAP REACTOR
P. M. Magee and R. W. Winson 10 Feb. 1966 47 p
(Contract AT(11-1)-GEN-8)
(NAA-SR-MEMO-11822) CFSTI: HC $3.00/MF $0.65

A set of transfer functions and differential and algebraic equations representing the heat transfer in a single reactor fuel rod and a single coolant channel were developed. It was assumed that the fuel rod was cooled by six adjacent coolant channels and that the coolant channel was heated by three adjacent fuel rods. The effect of eccentrically locating the fuel within the cladding was included as was the temperature dependence of H_2 conductivity and fuel specific heat. Two digital subroutines were written, one simulating the fuel rod and the other the coolant channel. These subroutines were linked by a third subroutine which provides the proper geometric coupling. A technique is described that is applicable to any hexagonal array core; however, the specific reactor described is the S8ER. In order to simulate another core, it would be necessary to modify the coupling subroutine. The subroutines are fully compatible with the digital program Upstart. However, owing to the extreme complexity and detail of the thermal model, it is recommended that the system not be operated as a closed loop. Rather, the core model should be used to obtain transient and steady state thermal response to programmed reactor power, coolant flow, and coolant inlet temperature as functions of time. Author (NSA)

N67-20925# Technische Hogeschool, Eindhoven (Netherlands). Lab. of Heat Transfer and Reactor Engineering.
THE STEADY STATE AND DYNAMIC BEHAVIOR OF A BOILING WATER REACTOR Quarterly Progress Report, 1 Jan.–1 Apr. 1966
Apr. 1966 21 p refs
(Contract EURATOM-030-64-1 TEEN)
(EURAEC-1682; WW-016-R-108; EUR-2869; QPR-21) CFSTI: HC $3.00/MF $0.65

Measurements are reported which have been carried out to check the influence of a changing waterlevel on the steady as well as the non-steady state characteristics of the hydraulic system. The effect appears to be negligible provided that the level is above the edge of the shroud. The results of the 50 mm and the 60 mm shroud measurements have been further analyzed. Void fraction data have been plotted as a function of the Martinelli–Nelson parameter. The figures indicate that the parameter X_{tt} might be a suitable parameter for correlation. Burnout data obtained from the measurements on the 50 mm and 60 mm shrouds are given as a function of saturation temperature and subcooling. Author (NSA)

N67-20930# General Electric Co., Schenectady, N. Y. Knolls Atomic Power Lab.
FRICTION TESTS BETWEEN ThO_2–UO_2 AND ZIRCALOY-4
J. Swota, L. G. Sisnyi, and W. A. Schreiner 7 Oct. 1966 15 p refs
(Contract W-31-109-ENG-52)
(KAPL-3166) CFSTI: HC $3.00/MF $0.65

Values for the coefficient of friction between 90 wt % ThO_2–10 wt % UO_2 material and reactor-grade Zircaloy-4 were determined as a function of surface conditions for both the oxide material and the alloy material, the ambient temperature, and the applied load or pressure. The surface condition of the test materials and the test temperature up to 750°F, had a significant effect on the coefficient of friction. Depending on the test conditions, values for the coefficient of friction ranged from 0.16 to 0.69. Author (NSA)

N67-20933# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
GRAPHITE: ADVANTAGES, LIMITATIONS, AND APPLICATIONS

R. E. Nightingale 5 May 1966 24 p refs Presented at the AIME Nucl. Met. Symp. on High Temp. Nucl. Fuels, Delevan, Wis.
(Contract AT(45-1)-1830)
(BNWL-SA-689; CONF-661003-2) CFSTI: HC $3.00/MF $0.65

The properties of graphite and some advantages and limitations in its use in high-temperature nuclear applications are reviewed. Fabrication, crystal structure, nuclear properties, strength, thermal conductivity, chemical properties, and density are discussed. Uses of graphite as moderator material and as matrix material for fuel particles are considered briefly. NSA

N67-20935# Du Pont de Nemours (E. I.) and Co., Aiken, S. C. Savannah River Lab.
LATTICE MEASUREMENTS ON TUBULAR FUEL ASSEMBLIES IN D_2O
Harold R. Fike Aug. 1966 16 p refs
(Contract AT(07-2)-1)
(DP-1054) CFSTI: HC $3.00/MF $0.65

Substitution measurements in the Process Development Pile (PDP) were used to determine bucklings and diffusion coefficients for D_2O-moderated lattices of tubular natural UO_2 fuel assemblies. Four types of assemblies were investigated at triangular lattice pitches of 9.33, 11.10, and 12.12 inches. Coolants within the different assemblies included D_2O, air, and mockups of H_2O fog and organic liquids. Author (NSA)

N67-20940# Du Pont De Nemours (E. I.) and Co., Aiken, S. C. Savannah River Lab.
METALLOGRAPHY OF CURIUM-244 OXIDES
P. K. Smith and J. T. Livingston 9 Jun. 1966 14 p refs Presented at the 20th Metallographic Group Meeting, Rocky Flats, Colo., 18–20 May 1966 Submitted for publication
(Contract AT(07-2)-1)
(DPMS-66-8; CONF-660518-7) CFSTI: HC $3.00/MF $0.65

Metallographic facilities and methods for production and fabrication of Cm_2O_3 fuels for isotopic heat sources are described. Information on microstructures of curium oxides is presented along with information on microstructures of spinels and perovskite-type ceramics produced by reactions between alumina and curium oxide at 1600°C. NSA

N67-20947# General Electric Co., San Jose, Calif. Atomic Power Equipment Dept.
REACTOR PRIMARY COOLANT SYSTEM RUPTURE STUDY Quarterly Progress Report, Jan.–Mar. 1966
Apr. 1966 120 p refs
(Contract AT(04-3)-189)
(GEAP-5147; QPR-4) CFSTI: HC $3.00/MF $0.65

A stress analysis model of a typical BWR primary piping system was developed to provide input data for calculating system reliability. Initial calculations were made to determine normal stress levels in the system. The results indicate that stresses normally encountered are below code allowable values. Computer code development has continued and all necessary equations for the plate and panel elements were developed and programmed. A series of low-C steel impact specimens were prepared for investigation of the effect of side notching on measured crack toughness and the effect of nitriding. Development of a procedure to calculate the strain energy release rate (G) as a function of crack length for a circumferentially-cracked straight pipe section under combined pressure and bending loads was initiated during the period. Fatigue crack growth rate studies have continued. Experimental work consisted of measurement of cyclic crack growth in wide plates of 2-1/4 Cr-1 Mo steel at room temperature and at 540°F, and in Type-304 stainless steel at room temperature. Preliminary results indicate a small but significant increase in crack growth rate in the low alloy steel at 540°F. The type-304 stainless steel tests show a very significant influence of crack shape geometry; as crack-length-to-depth-ratio increases, the crack growth rate increases. In the crack initiation studies, fatigue testing of edge-notched flat-plate specimens was completed. C steel and 2-1/4 Cr-1 Mo steel specimens endure about 120,000 cycles at a nominal stress equivalent to their respective yield strengths. Type-304 stainless steel specimens fail after 35,000 cycles at a stress level equivalent to its yield strength. At higher stresses, the type-304 stainless steel has a higher fatigue life relative to the other two materials. NSA

N67-20956# Osterreichische Studiengesellschaft fur Atomenergie G.m.b.H., Seibersdorf (Austria).
INVESTIGATION OF FISSION PRODUCT DIFFUSION IN COATINGS OF FUEL ELEMENTS FOR HIGH TEMPERATURE REACTORS, PART II [UNTERSUCHUNG UEBER DIE SPALTPRODUKTVERTEILUNG IN DER BESCHICHTUNG VON BERNNSTOFFTEILCHEN FUER HOCHTEMPERATURREAKTOREN, II]
L. Szterk and H. Bildstein 1966 21 p refs In GERMAN; ENGLISH summary Submitted for publication
(SGAE-CH-36/1966)

The diffusion of fission products in the coating of Pyrolytic carbon-coated fuel particles for high temperature reactors was investigated. The coating of irradiated particles was removed stepwise chemically and the resulting etching solutions analyzed by gamma spectrometry. The experiments were performed on particles with sintered and melted $(U,Th)C_2$–kernels. The release of fission products as Ba/La, Zr, Ru, and Cs is described. Author (NSA)

N67-20966# Atomics International, Canoga Park, Calif.
REVIEW OF SCTI BELLOWS FAILURES
J. A. Leppard 26 May 1966 15 p refs
(Contract AT(11-1)-GEN-8)
(NAA-SR-MEMO-11970) CFSTI: HC $3.00/MF $0.65

Specimens of each of three failed bellows were examinad metallurgically; the material (304 SS) was found to be sensitized and corroded. The corrosion was intergranular and resulted in the occurrence of multiple cracks when the bellows were flexed during sodium loop operation. Investigation revealed that a baking operation had been performed at 1300°F to remove volatile materials between the two plies of the bellows. Because intergranular corrosion occurs with aqueous corrodants, it was concluded that this corrosion occurred during the thirty month period between fabrication and installation in the SCTI plant. Each of the twelve original bellows expansion assemblies was manufactured by the same process, but the extent of exposure to corrodants after manufacture was indeterminant. Short of replacement, no action could be taken to assure long service of the remaining original units. The manufacturing process specification was changed to reduce the bakeout temperature from 1300°F to 800°F to prevent sensitization. Additional requirements were made covering shipping, handling, and storage techniques to eliminate corrosion. Author (NSA)

N67-20967# General Electric Co., Cincinnati, Ohio. Nuclear Materials and Propulsion Operation.
SAHARA STATUS REPORT: A MODIFIED ORNL REACTOR BURNUP CODE
W. Z. Prickett 1 Aug. 1966 129 p refs
(Contract AT(40-1)-2847)
(GEMP-432) CFSTI: HC $3.00/MF $0.65

The current status of the SAHARA burnup code for the GE-625 computer is summarized. This code is based on the ORNL-LTM code. Recommendations are indicated for further improvement in the code. User instructions and sample problems are provided. Complete listings are included. Author (NSA)

N67-20968# Atomic Energy of Canada, Ltd., Chalk River (Ontario).
SAP CLAD URANIUM CARBIDE FUEL ELEMENTS
R. D. MacDonald, W. G. Mathers, A. M. Tachis, and J. E. May May 1966 82 p refs
(AECL-2571)

Ten SAP-sheathed UC elements, with Ar filling-gas, were irradiated at linear power ratings up to 1040 w/cm, in the organic-cooled loop of NRX. The composition of the arc-cast 14.0 mm diameter pellets varied from 4.6 to 4.8 Mwd/t U. % C. Each element contained six UC pellets in a finned SAP tube. Fuel burnups ranged from 3450 to 11,100 Mwd/tU. Two elements had central thermocouples; in the hottest element the measured central temperature was 1620°C at the start of the irradiation, but decreased to 1020°C at the end. This decreasing temperature was attributed to increasing fuel-to-sheath heat conductance across the argon-filled gap because of the fuel swelling. The irradiation was stopped when the sheath of the element with the highest burnup split between fins. The failure was probably caused by the expanding fuel over-straining the SAP. Isolated reaction between the fuel and sheath was observed, but the maximum penetration of the SAP was only 0.03 mm. The UC pellets had residual diametral expansions up to 1.5% while the maximum decrease in UC density was 6%. The isotropic swelling of the fuel was generally consistent with other published results. Irradiation-induced porosity, both within grains and at boundaries, was more plentiful from the pellet mid-radius inwards. Before irradiation free U was observed throughout hypostoichiometric pellets, predominantly in grain boundaries. Afterwards, much of this U was in grain boundaries near the periphery. In most pellets containing <4.65 wt % C, U had migrated to the end-dishing between pellets and to axial holes containing the thermocouples. Grain boundary movement was found in several pellets; small pores marked the new locations of boundaries and larger pores outlined the earlier positions. The percentage of fission gas released increased with fuel temperature, but appeared independent of carbon content. The maximum release was 1.4%. Author (NSA)

N67-20977# Douglas United Nuclear, Inc., Richland, Wash.
RADIOLOGICAL ASPECTS OF THE DEACTIVATION OF HANFORD PRODUCTION REACTORS
Lynn R. Wallis and Carl D. Corbit 9 Aug. 1966 40 p refs Presented at the 1st Intern. Congr. of the Intern. Radiation Protect. Assoc., Rome
(Contract AT(45-1)-1857)
(DUN-SA-14; CONF-660920-8) CFSTI: HC $3.00/MF $0.65

The deactivation procedures and monitoring and control programs are reviewed for the deactivation of three Hanford reactors. Experience gained over a one year period indicates the radiological criteria adhered to during the deactivation were sufficiently restrictive and the periodic radiation and contamination surveillance program for the reactors is adequate. NSA

N67-20980# Atomics International, Canoga Park, Calif.
RESONANCE PARAMETER LIBRARY FOR THE TRIX-1 CODE
J. M. Otter 2 Aug. 1966 27 p refs
(Contract AT(11-1)-GEN-8)
(NAA-SR-MEMO-12102) CFSTI: HC $3.00/MF $0.65

Resonance parameters from recent measurements and evaluations were compiled to form an updated library for the TRIX-1 code. The code was modified to print the data of revision of each isotope. The contents of the library are listed and the references for all parameters given. Author (NSA)

N67-20991# Atomics International, Canoga Park, Calif.
SECONDARY SODIUM PIPING DESIGN WITHOUT BELLOWS. SODIUM COMPONENT TEST FACILITY STUDY REPORT
G. Landler 2 May 1966 88 p refs
(Contract AT(11-1)-GEN-8)
(NAA-SR-MEMO-11941) CFSTI: HC $3.00/MF $0.65

Bellows-free design of the secondary sodium system in the Sodium Component Test Installation (SCTI) is feasible. The results of the study is an isometric layout of the sodium inlet and outlet lines of the B&W steam generator, without bellows type expansion joints. The feasibility studies performed on these piping configurations demonstrated compliance with the requirements of the American Standard Code for Pressure Piping ASA B31.1 and with the manufacturers' requirements assuring structural integrity of the process equipment. A review by the C.F. Braum and Company has found the piping configurations reasonable and sound. Supporting studies related to the adequacy of the equipment arrangement and to compliance with process requirements are included. Author (NSA)

N67-20994# Atomics International, Canoga Park, Calif.
SNAP-10A FSM-4 PERFORMANCE ANALYSIS—NAK LOADING AND THERMAL REFERENCE TEST
G. E. Berg 15 Sep. 1964 28 p refs
(Contract AT(11-1)-GEN-3)
(NAA-SR-MEMO-10446) CFSTI: HC $3.00/MF $0.65

Data taken during NaK loading and thermal reference testing of the SNAP-10A FSM-4 non-nuclear ground test system are presented and analyzed. For purposes of analysis the performance was divided into five categories system temperatures, system heat losses, converter electrical performance, pump performance, and flight instrumentation performance. In each category emphasis was placed on comparison of measured data to predicted performance and thermal reference performance of the 10FSM-1 and 10FS-1 systems. In almost every case both FSM-4 performance and agreement with predicted values were excellent. An average of 509 watts was produced at a core outlet temperature of 1011°F. The only important problem was a low converter to ground resistance which would have caused a very small decrease in power output if the system had been grounded. Author (NSA)

N67-21002# California Univ., Livermore. Lawrence Radiation Lab.
PROGRAMMED MECHANICAL DESIGN OF AIR-CORE SOLENOIDS CONSTRUCTED FROM HOLLOW CONDUCTOR
Arthur R. Harvey 23 Sep. 1966 12 p Presented at the Symp. on Eng. Probl. of Controlled Thermonucl. Res., Gatlinburg, Tenn., 3–6 Oct. 1966. Submitted for publication
(Contract W-7405-ENG-48)
(UCRL-70029; CONF-661016-17) CFSTI: HC $3.00/MF $0.65

A brief description is given for approaching computerized solutions for hollow-conductor solenoids, with the emphasis placed on the role of the conductor. NSA

N67-21013# Societe Belge Pour l'Industrie Nucleaire, Brussels (Belgium).
USE OF PLUTONIUM AS A FUEL IN NUCLEAR REACTORS Quarterly Report, 1 Jan.–31 Mar. 1966
May 1966 74 p refs
(Contract EURATOM-001-64-1 TRUB)
(EURAEC-1666; BN-6605-02; EUR-2858; QR-9) CFSTI: HC $3.00/MF $0.65

Research was centered chiefly around detailed study of Pu recycling in the SENA power plant. The homogeneous ceramic oxide fuels required for the program will be prepared by fusion. Various parameters for this process were examined, and their values were determined by a series of tests on UO_2. The conditions for welding the fuel rod plugs to thin clads were defined. Tests in which the vibration conditions were varied seem to show that

heterogeneities in the Pu distribution may be affected by sweeping the resonance frequencies during filling. Densities of 90% TD were obtained in BR-3 type tubes by pneumatic vibration, whereas electrodynamic vibration gives a density of around 87% for the same tubes. A method for analyzing Cl_2, based on the analytical method for determining traces of Cl_2, was developed, since the standard method for Cl_2 analysis in UO_2 cannot be applied to samples containing PuO_2. A detailed study of the incidence of transversal defects, on nondestructive determination by counting the 384 keV line was made on SENA rods. Although their diameter is very different from that of the BR-3/Vulcain rods, the conclusions indicate that here too the nondestructive control method reveals heterogeneities in the Pu distribution. Analysis of the results obtained from the second series of irradiation tests in the Br-2 hydraulic conveyor was continued. The maximum power generated was evaluated at about 600 w/cm. On the basis of the metallographic sections, it can be stated that no important structural alteration occurred in the fuel, except perhaps for slight sintering of the grains. A third series was undertaken with a maximum value of 1-1/2 times the value obtained during previous irradiations. The chief aim of the neutron program is the determination of the nuclear characteristics of the UO_2–PuO_2–H_2O lattices, with a view to initiating the study of the recycling of Pu-enriched fuels in light water power reactors. Theoretical work comprises improvement of the set of formulas, adaptation of existing codes, and method calibration. Experimental work includes fundamental experiments on pulsed subcritical lattices and critical subassemblies, as well as experiments simulating recycling configurations in the SENA reactor. The study of thermalization in a heterogeneous medium continued, and was concerned chiefly with a calculation method for determining the thermal spectrum in a heterogeneous UO_2–PuO_2–H_2O cell. Various thermalization models were considered. Adaptation for an IBM 360 of the codes currently used with the IBM 1620 computer was continued. The study of the lattices made up of fuel elements from the Thetis reactor was completed by a set of reactive effect measurements and the determination of decay constant alpha using the correlation method. The experimental program of subcritical approximations which will use the VENUS/Vulcain fuel was clarified. The adaptation of the VENUS critical plant for the experimental program was considered. Preliminary designs were prepared and execution was started. The main parameters to be considered when examining the incidence of Pu recycling on fuel economy in the SENA reactor were defined. A basic concept was adopted to allow work to start, and a number of variants were selected. Author (NSA)

N67-21015# Atomics International, Canoga Park, Calif.
WEIGHT SCALING FACTORS FOR SNAP REACTOR SHIELDS
J. L. Hedgecock and G. E. German 8 Jun. 1966 14 p refs
(Contract AT(11-1)-GEN-8)
(NAA-SR-MEMO-11971) CFSTI: HC $3.00/MF $0.65

A series of weight scaling factor graphs are presented for the following basic shield configurations: instrument-rated shadow shields, man-rated shadow shields, and man-rated four-pi shields. Each graph shows the weight ratio of a new shield design with respect to a base case design as a function of one parameter. The parameters for which the weight ratios are given include reactor power, dose rates, and the principal overall dimensions. Each parameter is considered to be essentially independent of the other parameters, thus the total weight ratio for a new design is the product of the weight ratios for the individual parameters. Shield weights for each of the base case designs are given. Author (NSA)

N67-21017# Atomics International, Canoga Park, Calif.
GAS-SURFACE INTERACTIONS FOR SNAP FUEL PARTICLE REENTRY
H. E. Johnson 21 Mar. 1966 43 p refs *Its* Thermo-Phys. Tech. Note No. 59
(Contract AT(11-1)-GEN-8)
(NAA-SR-MEMO-11845) CFSTI: HC $3.00/MF $0.65

A survey of various physical and chemical interaction processes of SNAP fuel particles re-entering the atmosphere has been made. The particles are expected to re-enter the atmosphere primarily in the transition flow regime with initial breakup due to air pressure forces overcoming surface tension forces as defined by the Weber criteria. Vapor pressure equations for SNAP fuel components with the Langmuir equation to calculate evaporation rates are given. Evaporation will then further reduce particle sizes from the primary ablation product sizes estimated by the Weber method. Chemical as well as physical interaction processes are considered with low temperature oxidation processes making a transition to high temperature processes. Zr and Zr alloys oxidize by cubic, parabolic, and linear rate laws. Metals apparently ignite at or before the transition from parabolic to linear kinetics. Dissolved fission products or atmospheric gases may cause explosions at various possible times during the particle temperature cycle. Recommendations are made in regard to improvements in the dual analytical–experimental program with three types of experimental programs: (1) simulation type experiments, (2) high temperature physical and chemical parameter determinations, and (3) fission product release studies. Author (NSA)

N67-21035# General Dynamics Corp., San Diego, Calif. General Atomic Div.
INELASTIC SCATTERING OF NEUTRONS BY REACTOR TYPE GRAPHITE
W. L. Whittemore *In* Brookhaven Natl. Lab. Inelastic Scattering of Neutrons by Condensed Systems Mar. 1966 p 94–95 refs (See N67-21022 10-24 CFSTI: HC $3.00/MF $0.65

The General Atomic neutron velocity selector was used to study the scattering of monoenergetic neutrons in the energy range 0.17 to 0.30 eV by a thin layer of reactor grade graphite. This measurement differs from previous ones in the use of higher energy incident neutrons which can excite directly the crystal energy levels. Egelstaff and Harris, using cold neutrons, found energy levels at 0.08, 0.12, and ≈0.18 eV. Their 0.12-eV level is in disagreement with the level 0.108 eV predicted by Young and Koppel. The present data give energy levels at 0.055, 0.08, and 0.12 eV, and a broader level in the range 0.16 to 0.20 eV, in agreement with the predictions of Young and Koppel except for the 0.12-eV level. The data confirm the 0.12-eV level reported by Egelstaff. The effect of coherent scattering to alter peaks in the scattering cross section is believed not to be significant. It appears that some of the force constants of Young and Koppel should be altered (consistent with the correct specific heat) to shift their level from ≈0.108 to 0.12 eV. Author (NSA)

N67-21064# Kernforschungsanlage, Juelich (West Germany). Zentralabteilung Forschungsreaktoren.
EXAMINATION OF THE EMERGENCY COOLING UNIT OF THE FRJ-2 (DIDO) REACTOR [UEBERPRUEFUNG DER NOTKUEHLANLAGE DES REAKTORS FRJ-2 (DIDO)]
H.-G. Paul and R. Haul Jun. 1964 20 p refs In GERMAN (JUL-235-RE) CFSTI: $3.00

Measurements on the reduced flow of heavy water in a nuclear reactor in the case of a break between the cooling elements and the reactor core showed that fuel elements will not melt as long as they are under water. It was concluded that activation of the emergency cooling system 5 minutes after pipeline break detection is sufficient to prevent melting of the nuclear fuel elements. Transl. by G.G.

N67-21065# Kernforschungsanlage, Juelich (West Germany). Arbeitsgruppe Reaktorbetrieb.

ACTIVITY MEASUREMENTS IN THE EXHAUST SYSTEM AND PRIMARY COOLING ZONE OF THE FRJ-1 (MERLIN) REACTOR AT 100 kW [AKTIVITAETSMESSUNGEN IM ABLUFT-SYSTEM UND PRIMAERKUEHLKREIS DES REAKTORS FRJ-1 (MERLIN) BEI 100 kW]

K. L. Frenkler May 1963 33 p refs In GERMAN
(JUL-111-RE) CFSTI: HC $3.00/MF $0.65

Measurements disclosed neither radioactive nuclides in the exhaust filters nor radioactive nitrogen in the air directly above the reactor's water surface, indicating that the convective flow in the water of the cylindrical part of the tank is <6.5 cm/sec with the circulation pumps off. The measured argon concentration in the drained radiation tube agreed with calculated values. A burner element damage was simulated by introducing a bare U-235 foil into the reactor core, and the radioactive nuclides Na 24, Ar 41, Kr 87, Kr 88, I 134, and I 135 were subsequently identified in the water. Total radioactivity of the water two hours after shutdown of the reactor was $10^{-4}\mu C/cm^3$. No alpha radiation was detected. Chemical analysis showed 9.4 ppm SiO_2 in the water. The conductivity mean was 2.5 μS/cm. The pH value was 5.2 and resulted from the presence of dissolved CO_2 in the water. Overall operation of the cooling loop and the exhaust system was fully satisfactory.
Transl. by K.W.

N67-21068# Kernforschungsanlage, Juelich (West Germany). Arbeitsgruppe Reaktorbetrieb.

WATER DISCHARGE MEASUREMENT IN THE COMPACT CORE OF THE FRJ-1 [WASSERDURCHFLUSSMESSUNGEN IM KOMPAKTEN KERN DES FRJ-1]

J. Jacquemin Jun. 1963 37 p refs In GERMAN
(JUL-125-RE) CFSTI: HC $3.00/MF $0.65

A compact core with a 17 fuel element mockup, six of which contained static tubes for measuring the flow rate, were fastened to part of the FRJ-1 reactor grid. The other part of the grid supported 14 reflector elements and 46 empty elements. Flow rate was measured at both experimental levels at about 14 m^3/h pro fuel element. Stepwise removal of 11 empty elements from the grid on both sides of the core lowered flow rate per fuel element to 8.2 m^3/h. A separate experiment was used to obtain the calibration curve for one Pitot tube. Small variations in experimental arrangements served to calibrate empty and reflector elements. Theoretical evaluations together with the calibration values established the pressure difference above the core at 0.16 kg/cm^2. Overall pressure differences of the primary cycle were measured as 1.89 kg/cm^2 at entrance and exit of the primary pumps.
Author

N67-21069# Kernforschungsanlage, Juelich (West Germany). Institut fuer Reaktorentwicklung.

COMPARISON OF SPECTRA AND SPECTRAL AVERAGE AMPLITUDES OF A TWO-COMPONENT SALT FUSION (MOSEL) [VERGLEICH VON SPEKTREN UND SPEKTRAL GEMITTELTEN GROESSEN EINER ZWEIKOMOONENTEN-SALZSCHMELZE-MOSEL]

W. P. Barthold, L. A. Wolf, and I. Graf Jul. 1965 60 p In GERMAN
(JUL-291-RG) CFSTI: HC $3.00/MF $0.65

Discussed were various supporting molten salt combinations for a projected reactor temperature of 700°C. UF_4 fuel element, and a ThF_4 breeder element. Spectral analytic evaluation of LiF, NaF, KF, BeF_2, and ZrF_4 melts gave the following results: The resonance enrichment probabilities between 5 and 10 mol% U^3F_4 were less than 0.001 for all supporting molten salt combinations and the thermal part of the overall reaction rate was unimportant.
Transl. by G.G.

N67-21070# Kernforschungsanlage, Juelich (West Germany). Zentralabteilung Forschungsreaktoren.

THE BEHAVIOR OF THE (MERLIN) FRJ-1 REACTOR BY THE LOSS OF FORCED COOLING, PART I [DAS VERHALTEN DES REAKTORS FRJ-1 (MERLIN) BEIM AUSFALL DER ZWANGSKUEHLUNG, AUFLAGE I]

May 1965 46 p refs In GERMAN
(JUL-259-RE) CFSTI: HC $3.00/MF $0.65

Thermocouples fastened to nuclear fuel elements were used to observe temperature variations of two different nuclear core configurations during the breakdown of the primary cooling pumps. The time until forced cooling water flow circulation changed to natural convection decreased with increased nuclear energy and reached about 7.5 seconds at 5 MW. Production variations caused by temperature effects were attributed to bubble formation 30 minutes after pump failure.
Transl. by G.G.

N67-21071# Kernforschungsanlage, Juelich (West Germany). Zentralabteilung Forschungsreaktoren.

THE BEHAVIOR OF THE (MERLIN) FRJ-1 REACTOR BY THE LOSS OF FORCED COOLING, PART II [DAS VERHALTEN DES REAKTORS FRJ-1 (MERLIN) BEIM AUSFALL DER ZWANGSKUEHLUNG AUFLAGE II]

E. Muench Aug. 1966 69 p refs In GERMAN
(JUL-407-RE) CFSTI: HC $3.00/MF $0.65

Experiments were performed to study the behavior of a nuclear water-moderated reactor in the case of cooling system failure. Reactor cooling pumps were stopped at the beginning megawatt region in order to observe cooling and fuel temperatures, as well as the reactor efficiency. Studies on a 4×5 element core and a 31 element core established a negative reaction temperature coefficient of about $5\cdot10^{-3}$ % Δ pro °C. Thermodynamic measurements showed that breakdown of the primary pumps without reactor shutdown can be compensated by the emergency cooling system of the reactor. Increased bubble formation and its connected increased heat transfer kept fuel plate temperatures below 150°C.
Transl. by G.G.

N67-21072# Kernforschungsanlage, Juelich (West Germany). Institut fuer Reaktorentwicklung.

COMPARISON OF SPECTRA AND SPECTRAL AVERAGE AMPLITUDES OF A THREE-COMPONENT ($NaF-BeF_2$) SALT FUSION (MOSEL) [VERGLEICH VON SPEKTREN UND SPEKTRAL GEMITTELTEN GROESSEN EINER DREIKOMPONENTEN ($NaF-BeF_2$)- SALZSCHMELZE-MOSEL]

W. P. Barthold, L. A. Wolf, and I. Graf Oct. 1965 90 p refs In GERMAN
(JUL-315-RG) CFSTI: HC $3.00/MF $0.65

Studied were the effects of core dimension, thorium fluoride content, and uranium enrichment on the energy spectrum of a fast molten-salt epithermal reactor (MOSEL) with internal cooling system. Equal parts of NaF and BeF_2 were used as supporting salt mixtures for the fuel element as well as for the breeding element.
Author

N67-21073# Kernforschungsanlage, Juelich (West Germany). Arbeitsgruppe Institut fuer Reaktorentwicklung.

MULTIGROUP-EFFECTIVE CROSS SECTION FOR THE STRUCTURE MATERIAL, SOLUTION MATERIAL, AND BREEDING MATERIAL OF THE MOSEL REACTOR [MULTIGRUPPEN-WIRKUNGSQUERSCHNITTE FUER DIE STRUKTUR-, LOESUNGS UND BRUTMATERIALIEN DES MOSEL-REAKTORS]

Hans H. Jung Dec. 1964 59 p refs In GERMAN
(JUL-214-RG) CFSTI: HC $3.00/MF $0.65

Presented are the multiple group cross sections of the 68-group structure codes for absorption, fission, and n-2n-processes of the following structural-, solution-, and breeder materials for the MOSEL reactor concept: Ni, Mo, Cr, Fe, Na, Be, F, and Th. Compiled references on basic data are included. Author

N67-21074 Kernforschungsanlage, Juelich (West Germany). Zentralabteilung Forschungsreatktoren.
INVESTIGATION OF ELECTROMAGNETIC COUPLING OF THE DIDO (FRJ-2) APPARATUS COARSE CONTROL LEVER [UNTERSUCHUNG DER ELEKTROMAGNETISCHEN KUPPLUNG DES DIDO (FRJ-2)-GROBSTEUERARMES]
G. Thamm May 1965 28 p refs In GERMAN
(JUL-266-RE) CFSTI: $3.00

Use of a nonconducting coil decreased the delayed release time of the electromagnetic clutch from 50 msec to 15 msec. This reaction did not seem to improve further by introduction of air spaces between clutch casing and tie rod. The study showed also that an effective reactor shutdown could be obtained by a faster start velocity of the magnetic clutch tie rod during drop release. Author

N67-21077# Kernforschungsanlage, Juelich (West Germany). Institut fuer Reaktorentwicklung.
BREEDING CONDITIONS OF AN EPITHERMAL SALT FUSION REACTOR. II: INTERNAL COOLING BY SODIUM [DAS BRUTVERHALTEN EINES EPITHERMISCHEN SALZ-SCHMELZENREAKTORS. II: INTERNE KUEHLUNG DURCH NATRIUM]
W. P. Barthold, L. A. Wolf, and I. Graf Mar. 1966 68 p refs In GERMAN
(JUL-380-RG) CFSTI: $3.00

Investigated was the breeding performance of an intermediate-fast molten-salt reactor (MOSEL). The structural material used for the ductwork and the blanket was Croley, and the cooling medium was sodium. Observed were the effects of the melting material combination, the utilized structural materials, and the fuel element combination on the breeding rate. Author

N67-21079 Kernforschungsanlage, Juelich (West Germany). Institut fuer Reaktorentwicklung.
BREEDING CONDITIONS OF AN EPITHERMAL SALT FUSION REACTOR. I: INTERNAL COOLING BY BLANKET MELTING
W. P. Barthold, L. A. Wolf, and I. Graf Mar. 1966 49 p refs In GERMAN
(JUL-362-RG) CFSTI: $3.00

The breeding conditions of intermediate-fast molten salt arrangements with internal heat exchangers were investigated. The blanket salt served also as cooling medium. The structural materials are Croloy and Inor-8, a nickel–steel alloy. Considered are the effects of the fluoride salt composition, the thorium contents, the size of the arrangement, the structural material, and the fuel composition. Also determined was the influence of variations in the effective cross sections on breeding conditions. Transl. by K.W.

N67-21080 Kernforschungsanlage, Juelich (West Germany). Zentralabteilung Forschungsreaktoren.
PRELIMINARY INVESTIGATION INTO THE PLANNED IMPULSE REACTOR PROJECT OF THE JUELICH NUCLEAR RESEARCH ESTABLISHMENT [VORUNTERSUCHUNGEN ZU DEM GEPLANTEN IMPULSREAKTOR-PROJEKT DER KERNFORSCHUNGSANLAGE JUELICH]
D. Biedermann, H. Kraemer, K. J. Kalker, and G. Thamm Feb. 1966 206 p refs In GERMAN
(JUL-343-RE) CFSTI: $3.00

Theoretical preliminary studies for the planning of an impulse reactor centered on the evaluation of various reactor concepts in regard to utilization and final specifications. Emphasis in the experimental program was placed on fuel element tests in regard to reactor safety and reactor development, as well as functional analyses of electronic structures at high radiation levels. Projected were thermal flux times of at least 10^{16} cm^{-2} at impulse duration of 60 to 100 msec. These requirements for the planned reactor necessitated a BeO or graphite matrix material for the solid moderator structure. Various nuclear and thermal flux calculations for a BeO and a graphite system showed optimal atomic fuel concentration 10^{-4} at half volume size and fuel inset for the BeO reactor. Also evaluated were temperature coefficients, kinetic properties, and thermodynamic characteristics for both fuel matrices having gas and water cooling systems. Transl. by G.G.

N67-21081# Kernforschungsanlage, Juelich (West Germany). Institut fuer Reaktorentwicklung.
ON SOME METHODS FOR THE EXPERIMENTAL DETERMINATION OF THE HIGH-SPEED FISSION FACTOR OF BERYLLIUM METAL AND BERYLLIUM OXIDE [UEBER EINIGE METHODEN ZUR EXPERIMENTELLEN BESTIMUNG DES SCHNELLSPALTFAKTORS VON BERYLLIUMMETALL UND BERYLLIUMOXYD]
Norbert Kirch, Paul H. Heckmann, and Rudolf Hecker Nov. 1965 33 p refs
(JUL-337-RG) CFSTI: HC $3.00/MF $0.65

Beryllium moderated reactors increased their neutron production from uranium fission by additonal Be^9 (n,2n) reaction. This reaction of fast neutrons from the reactor spectrum with beryllium gave rapid fission effects. Fast fission neutrons were moderated in spheres containing manganese sulfate solution or cadmium enriched scintillating fluid, respectively, and determined by photomultiplier. Transl. by G.G.

N67-21086# Kernforschungsanlage, Juelich (West Germany). Institut fuer Reaktorentwicklung.
THE BREEDING CONDITIONS OF AN EPITHERMAL SALT FUSION REACTOR. III: EXTERNAL COOLING THROUGH LEAD
W. P. Barthold, I. Graf, and L. A. Wolf Nov. 1965 149 p ref In GERMAN
(JUL-321-RG) CFSTI: HC $3.00/MF $0.65

Described is the breeding capacity of an epithermal molten-salt reactor with external lead cooling system. The effects of molten-salt composition and core dimensions on breeding ratio and time history were analyzed. Parametric evaluation showed that molten salt compositions of: (1) 24 Mol% ThF_4+UF_4—44 Mol% Li^7F—32 Mol% NaF; and (2) 27 Mol% Mol% ThF_4—83 Mol% Li^7F gave best results. Dimensional increase of the nuclear core lowered breeding capacity because the external breeding ratio weakened. Transl. by G.G.

N67-21087# Kernforschungsanlage, Juelich (West Germany). Institut fuer Reaktorentwicklung.
THERMAL EFFECTIVE CROSS SECTION AND RESONANCE ABSORPTION INTEGRALS OF FISSION PRODUCTS [THERMISCHE WIRKUNGSQUERSCHNITTE UND RESONANZABSORPTIONSINTEGRALE VON SPALTPRODUKTEN]
E. S. Stippel Dec. 1965 33 p refs In GERMAN
(JUL-354-RG) CFSTI: HC $3.00/MF $0.65

This survey on thermal effective nuclear cross sections and resonance integrals is arranged by elements and their isotopes. Isotopic σ_{th}(2200)-values and resonance integrals are shown together; resonance integrals were mostly considered without the 1/v-component. Measurements of heavy isotopes from ^{89}Ac 227 on were not included. Transl. by G.G.

N67-21088# Kernforschungsanlage, Juelich (West Germany). Zentralabteilung Forschungsreaktoren.
ANALYSIS OF CONCEIVABLE COARSE CONTROL ROD ACCIDENTS IN THE FRJ-2 REACTOR, PART 2 [ANALYSE DENKBARER GROBSTEUERARM-UNFAELLE AM REAKTOR FRJ-2]
G. Meister and K. Kalker Apr. 1964 54 p refs In GERMAN
(JUL-146-RE) CFSTI: HC $3.00/MF $0.65

Analyses of control rod malfunctions and their predicted interference in reactor efficiency and control culminated in the inclusion of period meters able to interrupt nuclear reaction processes before damage occurs. Proper automatic cut-off is insured when the period meter is programmed for the critical threshold values of brief negative periods. Transl. by G.G.

N67-21089# Kernforschungsanlage, Juelich (West Germany). Zentralinstitut fuer Reaktorexperimente.
H_2O STANDARD PILE [H_2O STANDARD-PILE]
G. Borchardt and B. Hasenclever Sep. 1964 16 p refs In GERMAN
(JUL-179-RX) CFSTI: HC $3.00/MF $0.65

Design and construction of a water moderator for neutron standardization is described. It incorporates a flexible coordinating system, a foil irradiation device, and a turntable for carrying measuring instruments and BF_3 counters in various arrangements. This turntable makes it possible to expose several foils at the same time to identical neutron flux. Transl. by G.G.

N67-21090# Kernforschungsanlage, Juelich (West Germany). Institut fuer Reaktorentwicklung.
PROCESSES FOR AUTOMATIC EXCHANGE OF SHELL PARTICLES BY SPHERICAL COMBUSTION ELEMENTS [VERFAHREN ZUM AUTOMATISCHEN AUSTAUSCH VON SCHALENTEILCHEN BEI KUGELFOERMIGEN BRENNELEMENTEN]
K. W. Baurmann, K. H. Hammelmann, and W. Tschakert Apr. 1966 29 p In GERMAN
(JUL-378-RG) CFSTI: HC $3.00/MF $0.65

Loose shell particles can be emptied from clogged nuclear fuel element spheres by drilling a hole through their casing for easy removal. The open drilling hole of the fuel element can be positioned mechanically so that particles get outside by themselves. Instrumentation was developed that: (1) rotates the sphere around one axis with concurrent tilting around a second axis; (2) rotates the sphere around one axis with tilting around the second axis and concurrent turnover; and (3) rotates the free supported sphere around two axes at the same time. Transl. by G.G.

N67-21092# Kernforschungsanlage, Juelich (West Germany). Zentralinstitut fuer Reaktorexperimente.
RECHARGING PROCESSES FOR REACTORS—LIST OF REFERENCES [AUSWECHSELVERFAHREN AN REAKTOREN—LITERATURHINWEISE]
F. Krueger Sep. 1964 21 p refs In GERMAN
(JUL-BIBL-8) CFSTI: HC $3.00/MF $0.65

A literature survey on construction principles on exchange devices for nuclear reactors is presented. It covers replacements of fuel elements, experimental cores and irradiation containers, vertical and horizontal inserts, and replacable radiation installations of various reactor types. Author

N67-21094# Kernforschungsanlage, Juelich (West Germany). Institut fuer Neutronenphysik.
THE ROTATING CRYSTAL-FLIGHT TIME SPECTROMETER FOR SUBTHERMAL NEUTRONS AT THE FRJ-2 REACTOR [DAS DREHKRISTALL-FLUGZEITSPEKTROMETER FUER SUBTHERMISHE NEUTRONEN AM FRJ-2]
A. Axmann and W. Gissler Dec. 1965 24 p refs In GERMAN
(JUL-338-NP) CFSTI: HC $3.00/MF $0.65

Described is a rotating crystal flight-time spectrometer that uses a single aluminum crystal to monochromatize the continuous reactor neutron beam and to chop it into short duration pulses. Scattered pulsed neutrons then travel a measured distance and their flight times are determined electronically. The chopper has a maximum rotation of about 20000 turns per minute; resolving power of the spectrometer depends on the primary resolution velocity for the incidence beam. Transl. by G.G.

N67-21098# Kernforschungsanlage, Juelich (West Germany). Zentralabteilung Forschungsreaktoren.
TEMPERATURES AND CRITICAL (BURN-OUT) PERFORMANCE OF A FUEL ELEMENT OF THE FRJ-2 (DIDO) REACTOR IN A LIMITED PERFORMANCE EXCURSION [TEMPERATUREN UND KRITISCHE (BURN-OUT) LEISTUNG EINES BRENNSTOFFELEMENTES DES REAKTORS FRJ-2 (DIDO) BEI EINER BEGRENZTEN LEISTUNGSEXKURSION]
H.-G. Paul Nov. 1965 41 p refs In GERMAN
(JUL-333-RE) CFSTI: HC $3.00/MF $0.65

Critical output calculations for a nuclear reactor fuel element in the case of cooling pump breakdown show that optimal temperatures can be increased without burnout damage to the element. The degree of increase depends on the thermal capacity of the fuel element, the convective heat transfer, and the heat transfer rate to water during the controlled output. Calculations for the DIDO reactor established as highest permissible rate of reactor output 60 MW and a high burnout possibility for the upper part of the fuel element in case of cooling flow breakdown. Transl. by G.G.

N67-21099# Kernforschungsanlage, Juelich (West Germany). Zentralabteilung Forschungsreaktoren.
TEMPERATURES OF BURNT-OFF FUEL ELEMENTS OF THE FRJ-2 REACTOR OUTSIDE THE REACTOR [TEMPERATUREN ABGEBRANNTER BRENNSTOFFELEMENTE DES REAKTORS FRJ-2 AUSSERHALB DES REAKTORS]
H.-G. Paul Nov. 1965 46 p refs In GERMAN
(JUL-316-RE) CFSTI: HC $3.00/MF $0.65

Reported experiments to determine the heat gain of reactor fuel elements from burnouts developed the following contributing parameters: (1) time lapse after fuel element cut-off; (2) output of fuel element before cut-off; (3) type and effectiveness of the cooling system; (4) cooling gas temperature; and (5) heat transfer from the surface of the fuel element. Transl. by G.G.

N67-21100# Kernforschungsanlage, Juelich (West Germany). Institut fuer Reaktorentwicklung.
THE BREEDING CONDITIONS OF AN EPITHERMAL SALT FUSION REACTOR. III: EXTERNAL COOLING THROUGH LEAD (APPENDIX) [DAS BRUTVERHALTEN EINES EPITHERMISCHEN SALZSCHMELZENREAKTORS. III: EXTERNE KUEHLUNG DURCH BLEI (NACHTRAG)]
W. P. Barthold, I. Graf, and L. A. Wolf Mar. 1966 73 p In GERMAN
(JUL-361-RG) CFSTI: HC $3.00/MF $0.65

Studied was the breeding capacity of an intermediate-fast molten-salt reactor with external lead cooling. The molten core consisted of $NaF-ZrF_4+UF_4$ to observe the effects of BeF_2 substitution by ZrF_4. Effects of various concentrations of $U^{28}F_4$ and ThF_4, as well as the influence of core dimensions on the breeding factor were determined. Author

N67-21203# Aktiebolaget Atomenergi, Stockholm (Sweden).
DESIGN AND ANALYSIS OF THE POWER CONTROL SYSTEM OF THE FAST ZERO ENERGY REACTOR FR-0
N. J. H. Schuch Dec. 1966 76 p refs
(AE-262) CFSTI: HC$3.00/MF$0.65

This report describes the power control by means of the fine-control rod and the design of the control system of the fast zero energy reactor FR-0 located in Studsvik, Sweden. System requirements and some operational conditions were used as design criteria. Manual and automatic control is possible. Variable electronic end-stops for the control rod have been designed, because of the special construction of the reactor and control rod. Noise in the control system caused by the reactor, detector and electronics caused disturbances of the control system at the lower power levels. The noise power-spectrum was measured. Statistical design methods, using the measured noise power-spectrum, were used to design filters, which will reduce the influence of the noise at the lower power levels. Root Loci sketches and Bode diagrams were used for stability analyses. The system was simulated on an analogue computer, taking into account even nonlinearities of the control system and noise. Typical cases of reactor operation were simulated and stability analysis performed. Author (ESRO) m

N67-21205# Kernforschungsanlage, Juelich (West Germany). Institut fuer Reaktorwerkstoffe.
DESIGN AND PROCEDURES FOR HANDLING HIGH-LEVEL ALPHA–GAMMA BOXES AT THE LABORATORY FOR RADIOACTIVE SOLIDS AT KFA JULICH
M. Herren Apr. 1965 22 p refs
(JUL-251-RW) CFSTI: HC$3.00/MF$0.65

Four concrete hot cells with sufficient shielding for 10^4 curies of a 1 MeV gamma emitter are designed for experiments on humidity-sensitive, very dusty, or alpha–gamma emitting reactor fuel materials. This paper discusses problems arising by (1) transfer operations of experimental materials and wastes into and out of boxes, and of boxes themselves into and out of the cells; (2) exchange, repair and maintenance of box equipment, and (3) plastic bagging techniques. Author

N67-21216# Kernforschungsanlage, Juelich (West Germany). Zentralinstitut fuer Reaktorexperimente.
BOILING WATER FUEL ELEMENT LOOP IN FRJ-2
M. Neumann, K. Reichardt, K. Muenchow, G. Bundesmann, P. Dehe et al Apr. 1966 16 p Presented at Intern. Symp. on In-Pile Irradiation Equipment and Tech., Harwell, England, 10–12 May 1966
(JUL-373-RB-RX) CFSTI: HC$3.00/MF$0.65

An irradiation facility, more of a capsule than a loop, has been developed to test rod type fuel elements under pressurized boiling water conditions. An arrangement of small discs inside the in-pile pressure vessel maintain surface boiling conditions along the fuel rod and the nuclear heat is transported to the surrounding wall of the vessel. The heat is removed by low pressure low temperature secondary cooling water flowing over the pressure vessel through the outer tubes, enabling the two inch diameter in-pile section to be made in aluminium alloy thus giving very low neutron flux depression and reactivity absorption. Laboratory measurements exhibit high burnout limits and close relation between rod surface temperature and pressure. Because of the in-pile heat exchange to secondary low pressure water the out of pile equipment serves only for control and measurement and for meeting safety demands. Two loops of this type, different in design pressure, were installed in the FRJ-2. Author

N67-21218# Kernforschungsanlage, Juelich (West Germany). Institut fuer Reaktorexperimente.
NEUTRON MEASUREMENTS WITH A PARAFFIN PILE [NEUTRONENMESSUNGEN MIT EINEN PARAFFINMEILER]
G. Borchardt and W. Schneider May 1963 67 p refs In GERMAN; ENGLISH summary
(JUL-140-RX) CFSTI: HC$3.00/MF$0.65

This report deals with relative and absolute measurements of the thermal and epithermal neutron flux in a cylindrical pile of paraffin in which is placed 0.5 C Ra–Be-source. The measurements were performed applying the well-known techniques by means of 0.020 mm thick circular Au disk foils of 1 cm^2 area. The results (for Cd ratios, the removal cross section, the experimental Fermi age, the spatial flux integral, etc.) have been compared and found in accordance with results found by other authors. The neutron source strength has been obtained as $7.60\cdot(1\pm0.02_5)\cdot10^6$ neutrons/sec which differs not inadmissible from the calibration value $7.81\cdot(1\pm0.03)\cdot10^6$ neutrons/sec of our source. Author

N67-21403 Polish Academy of Sciences, Warsaw. Inst. of Nuclear Research.
MEASUREMENT OF NEUTRON DENSITY DISTRIBUTIONS IN MULTILAYER UNIT CELLS. III. RESULTS FOR ANNA REACTOR CELL WITH WATER 19.8 Cm LATTICE PITCH [POMIARY ROZKLADOW GESTOSCI NEUTRONOW W WIELOWARSTWOWYCH KOMORCACH REAKTOROWOCH III. WYNIKI DLA KOMORKI ELEMENTARNEJ REAKTORA ANNA O SKOKU 19.8 Cm, ZAWIERAJACEJ WODE]
L. Adamski, E. T. Jozefowicz, K. Jozefowicz, and A. I. Elcherif Jun. 1966 10 p ref
(INR-724/IXA/R) CFSTI: $3.00

Intracell neutron density distribution in Anna reactor core with water, 19.8 cm lattice pitch, was measured using the spiral detector method. The results are given in the form of distributions of bare and subcadmium copper activities. Author

N67-21404 Polish Academy of Sciences, Warsaw. Inst. of Nuclear Research.
MEASUREMENT OF NEUTRON DENSITY DISTRIBUTIONS IN MULTILAYER UNIT CELLS. IV. RESULTS FOR ANNA REACTOR CELLS WITHOUT WATER, 14.0 AND 19.8 LATTICE PITCHES [POMIARY ROZKLADOW GESTOSCI NEUTRONOW W WIELOWARSTWOWYCH KOMORKACH REAKTOROWYCH IV. WYNIKI DLA KOMOREK ELEMENTARNYCH REAKTORA ANNA SCOKACH SIATKI 140 I 19.8 CM, NIE ZAWIERAJACYCH WODY]
L. Adamski, E. T. Jozefowicz, K. Jozefowicz, and A. I. Elcherif Jun. 1966 18 p refs
(INR-730/IXZ/R) CFSTI: $3.00

Intracell neutron density distributions in Anna reactor cores without water, 14.0 and 19.8 cm lattice pitches, were measured using the spiral detector method. The results are given in the form of distributions of bare and subcadmium copper activities. Author

N67-21407 Central Lab. for Radiological Protection, Warsaw (Poland).
THERMOLUMINESCENT DOSIMETER WITH MEMORY EFFECT [DOWKOMIERZ TERMOLUMINESCENCYJNY Z PAMIECIA]
J. Roman, M. Wolska, J. Wysopolski, and Z. Urbanowicz 1966 13 p Presented at the 2d Health Phys. Symp., Pecs, Hungary, 1966
(CLOR/56/D) CFSTI: $3.00

A lithium fluoride thermoluminescent phosphor with two well separated glow maxima has been developed. The thermoluminescent properties of the phosphor and the dosimeter operating characteristics are given. The dosimeter shows memory effect based on a multiple peak technique permitting the accurate re-reading of the accumulated dose without loss of information. Author

N67-21408 Central Lab. for Radiological Protection, Warsaw (Poland).
FILM-BADGES FILTER COMBINATIONS FOR MEASUREMENT OF X AND GAMMA RADIATION ABOVE 75 KeV [DOBOR FILTROW W DAWKOMIERZU FOTOMETRYCZNYM DO POMIARU PROMIENIOWANIA X I GAMMA O ENERGII POWYZEJ 75 KeV]
T. Musialowicz and J. Wysopoiski 1966 21 p refs In POLISH
(CLOR-51/D) CFSTI: $3.00

The film response has been investigated using normally filtered X-ray spectra, 50 kV–200 kV, and gamma emitters I-131, Cs-137, Ra-226 and Co-60. The best linearity of the response in energy range 75 keV to 1.25 MeV has been obtained with a filter of 0.3 mm Pb+0.6 mm Sn (tin adjacent to film). For this filter the relative response of the film to Ra-226 radiation at 0° incidence in mentioned energy range was between 1 to 1.1. Author

N67-21410 Polish Academy of Sciences, Warsaw. Inst. of Nuclear Research.
PROBLEM OF REACTOR SHELL [ZAGADNIENIE POWLOKI REAKTOROWEJ]
Lech Szymendera Jan. 1966 104 p refs Submitted for publication
(INR-685/IX/RP) CFSTI: $3.00

The general formulation of the problem, including the formal definition of the reactor shell and the set of basic equations describing this object, are given. Because these basic equations consist of neutron and gamma transport equations and the thermoelastic equations, which are coupled by the temperature-variable, the purpose is to present a suitable method which enables one to solve all these equations in coupled form. This is done by application of the perturbation and the successive approximation method, which leads to the linearization of the problem. Author

N67-21465*# Oak Ridge National Lab., Tenn.
AN APPROXIMATE METHOD FOR DETERMINING ALLOWABLE STRESS RATES FOR CAPSULES CONTAINING HELIUM-PRODUCING ISOTOPES
R. L. Stephenson [1966] 15 p ref
(NASA Order C-64217-A; Contract W-7405-ENG-26)
(NASA-CR-83196; ORNL-TM-1436, Rev.) CFSTI: HC $3.00/MF $0.65 CSCL 18K

A method was devised for calculating failure times under certain conditions of predictably varying stress and temperature from conventional creep data. A computer program was written for making the associated calculations and plotting resulting curves. A sample set of data was used to verify the workability of the program. Within certain limitations, this method can be used to predict the mechanical performance of isotope-containing capsules from conventional mechanical property data. Author (NSA)

N67-21469# Oak Ridge National Lab., Tenn.
MATHEMATICAL MODEL FOR THE HIGH FLUX ISOTOPE REACTOR REACTIVITY CALCULATION
B. R. Lawrence, H. P. Danforth, and J. B. Bullock 24 Oct. 1966 27 p refs
(Contract W-7405-ENG-26)
(ORNL-TM-1472) CFSTI: HC $3.00/MF $0.65

A description is given of a model for calculating expected reactivity changes of the High Flux Isotope Reactor by means of an on-line digital computer. The information provided by the model, together with other information, will be used by the on line computer to grant permission for withdrawal of the reactor shim plates. The model uses effective one-energy group microscopic cross sections obtained from the results of separate, more detailed multigroup space-dependent calculations. Perturbation theory with neutron importance weighting is used to account for marked spatial flux distribution changes during the life of a core. The model was programmed for the CDC-1604 computer, and the calculated reactivity change for operation at full power (using preliminary constants) showed an agreement of 0.5% compared with the multigroup space-dependent results. Author (NSA)

N67-21479# Oak Ridge National Lab., Tenn.
MATERIALS COMPATIBILITY AND CORROSION STUDIES FOR THE ARGONNE ADVANCED RESEARCH REACTOR
J. C. Griess and J. L. English Nov. 1966 42 p refs
(Contract W-7405-ENG-26)
(ORNL-4034) CFSTI: HC $3.00/MF $0.65

A material compatibility and corrosion investigation was conducted to determine the extent of corrosion to be expected in certain parts of the Argonne Advanced Research Reactor (AARR). The areas of concern were the Be reflector, the Al beam tubes and the stainless steel fuel element cladding, all of which are exposed to the primary coolant. All experiments were conducted in deionized water with a specific resistivity of 1 million ohm–cm or greater. The Be was free of localized attack, and neither crevices nor contact with stainless steel or Al produced adverse effects. The ratio of Be surface area to volume of water in the AARR is 2.3 cm^2/liter and the Be reflector would be expected to corrode at a rate between 1.1 and 2.8 mils/yr, either of which would be acceptable. The corrosion of 6061-T6 Al, the material from which the beam tubes will be made, results in the formation of an insulating layer of corrosion products. Test results indicate that if the surface temperature of the beam tubes in the AARR can be maintained at 200°F or less, the rate of corrosion, and consequently the rate of corrosion-product buildup on the surfaces, will be low enough to prevent excessive temperatures in the beam tube walls. Tests showed that in type 304 stainless steel after a 1000-hr exposure at a heat flux of 4.0×10^6 Btu/hr-ft^2, numerous shallow (≈0.2 mil deep) cracks were present on the cooled surface. In a comparable test in which the heat flux was 2.1×10^6 Btu/hr-ft^2 (hot-spot heat flux for 100 Mw operation of AARR) and the exposure time was 2000 hr, no cracks were found. In view of the failures experienced in stainless steel fuel-element cladding in both pressurized and boiling water reactors, it is recommended that further investigation into this type of cracking be carried out. NSA

N67-21481# Oak Ridge National Lab., Tenn.
ORNL VERSION OF THEME 1 CODE: A THERMAL-HYDRAULIC CODE FOR ANALYSIS OF THE HOT CHANNEL IN A FUEL BUNDLE
J. P. Sanders Nov. 1966 45 p refs
(Contract W-7405-ENG-26)
(ORNL-4015) CFSTI: HC $3.00/MF $0.65

A code developed to study the effect of the design parameters on the thermal and hydraulic conditions for axial flow with intersubchannel mixing in fuel bundles is described. The program is used to examine the conditions in hot subchannels and represents the remainder of the flow channel by its thermal and hydraulic equivalents. After specifying the major reactor characteristics, one of three options may be selected to search for acceptable values of certain parameters within the design limitations. These are the orificing factor, the channel average velocity, and the reactor temperature change. All these options may be used to select the corresponding number of total reactor flow channels. In a fourth option, the number of flow channels is specified, and the resultant thermal conditions are calculated. Mixing is represented by a mixing factor that gives the ratio of the differences in the temperature change without mixing and with mixing to the differences

without mixing and with complete mixing. Thermal conditions are calculated at those points preselected by the input flux information. Author (NSA)

N67-21510# Atomics International, Canoga Park, Calif.
FINAL SNAPSHOT PERFORMANCE REPORT
G. E. Berg 15 Aug. 1966 289 p refs
(Contract AT(11-1)-GEN-8)
(NAA-SR-11934) CFSTI: HC$3.00/MF$0.65

An evaluation of overall system and individual component performance during all phases of the flight test is presented for SNAP 10A. In the evaluation special emphasis is placed on maximizing the amount of information obtained regarding the effect of the launch and space environments on the operation and performance of a nuclear thermoelectric system. In general the in-flight data agree with ground test results or extrapolation of those results to space. NSA

N67-21514# Argonne National Lab., Ill.
FARET CONTROL ROD DRIVE MECHANISMS
E. Hutter, T. E. Sullivan, and G. D. Giorgis Jun. 1966 36 p refs
(Contract W-31-109-ENG-38)
(ANL-7158) CFSTI: HC$3.00/MF$0.65

Faret was designed to be a 50-MW(t) sodium-cooled fast reactor experimental facility. Twelve control drives, operating above the reactor vessel, but inside of a large shielded cell, were to move 12 poison control rods over a 24-in. vertical distance. The control drives are electromechanical devices, that include pneumatic scram accelerators and hydraulic decelerators. A gripper mechanism at the lower end is submerged in 1150°F sodium and is remotely controlled to grip or to release a control rod. The detailed design of the control drive cluster, its operating characteristics, and preliminary tests of some control drive components are described. Author (NSA)

N67-21530# Oak Ridge National Lab., Tenn.
PSUEDO-RANDOM BINARY SIGNAL FOR FREQUENCY RESPONSE TESTING
T. W. Kerlin 23 Sep. 1966 55 p refs
(Contract W-7405-ENG-26)
(ORNL-TM-1662) CFSTI: HC$3.00/MF$0.65

The characteristics of a pseudo-random test signal were examined to evaluate it as a tool for frequency response testing in nuclear reactors. The frequency characteristics of the pseudo-random signal were determined. This required an evaluation of the dependence of the relative amplitudes of the harmonics on the number of binary bits in the sequence and the duration of each bit. Two types of data analysis were investigated. One is the indirect method, which requires autocorrelation of the input signal, cross-correlation of input and output signals, and subsequent Fourier analysis. The other is the direct method, involving filtering, squaring, cross multiplying, and time averaging of the signals. The error owing to improper selection of analysis frequencies was determined for both methods. Results of pseudo-random binary tests made on the Molten-Salt Reactor Experiment are included. These results support the theoretical conclusions. Author (NSA)

N67-21545# Gosudarstvennyi Komitet Po Ispolzovaniyu Atomnoi Energii, Moscow (USSR). Institut Atomnoi Energii.
NEW TYPE CRYOSTATS FOR SUPERCONDUCTING SOLENOIDS [KRIOSTATY NOVOGO TIPA DLYA SVERKHPROVODYASHCHIKH SOLENOIDOV]
V. E. Keilin 1966 12 p In RUSSIAN
(IAE-1178)

The construction of cryostats with wide openings is described. They are particularly convenient for the experimental work with large-scale superconducting solenoids. The functions of the heat bridge and the screen are joined in a single unit. Such cryostats may be used also without the screen cooled by liquid nitrogen. The rate of helium evaporation is at the same time approximately the same as in the cryostats of corresponding dimensions with nitrogen screening (for instance, a cryostat with internal diameter of 200 mm evaporates about 600 to 700 cm^3/hour of liquid helium). During work with a nitrogen screen one can significantly reduce the rate of helium evaporation. Several versions of such cryostats with transparent central opening were built and tested. These cryostats are distinguished by a high strength and reliability, with a simplest possible construction. Cryostats of the same type with an internal diameter of more than 300°mm are described. NSA

N67-21547# General Dynamics Corp., San Diego, Calif. John Jay Hopkins Lab. for Pure and Applied Science.
POWER DISTRIBUTION IN 330 Mw HTGR INITIAL CORE
V. Malakhof and W. Simon 27 Apr. 1966 25 p refs
(Contract AT(04-3)-633)
(GAMD-6651) CFSTI: HC$3.00/MF$0.65

The power distribution of the 330 HW(e) High-temperature Gas-cooled Reactor (HTGR) core was studied. The computations were performed for the initial core at a uniform fuel temperature of 1300°K and a uniform moderator temperature of 1200°K. The perturbation of the power distribution due to control-rod insertion, or arbitrary variation of Th feed concentration in certain refueling zones, was investigated. Radial and axial power shapes are in reasonable agreement with the predictions from the one-dimensional calculations. If the Th loading in the bottom zone of the outer ring of fuel elements is reduced to the maximum level permitted by space limitations, no major perturbation of the power distribution is expected in either this fuel zone or in the adjacent zones. A control-rod pair, partially inserted in the central patch, results in small perturbations in the power distributions of the adjacent patches and has almost no effect on the rest of the core. Author (NSA)

N67-21561# Brookhaven National Lab., Upton, N. Y.
HFBR: A SOURCE REACTOR FOR NEUTRON BEAMS
J. M. Hendrie and H. J. C. Kouts Sep. 1966 29 p refs Presented at the AEC-ENEA Seminar on Intense Neutron Sources, Santa Fe, N. Mex. 19–23 Sep. 1966
(Contract AT(30-2)-GEN-16)
(BNL-10610; CONF-660925-4) CFSTI: HC$3.00/MF$0.65

The neutron beam facilities of HFBR were described. The heavy water cooled, moderated and reflected reactor was constructed to provide neutrons for physics and chemistry experimentation. The reactor was designed primarily for external neutron beam experiments, and the core, reflector, and beam holes are arranged to enhance the low energy neutron flux in the beams, while decreasing the fast background. Nine of the 16 beam holes are for external beam experiments and the remaining facilities are for irradiation experiments. NSA

N67-21577# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
NEUTRON SENSITIVE CRITICALITY DETECTOR
P. C. Friend 27 Oct. 1966 7 p Presented at the 13th Ann. Nucl. Sci. Symp., Boston
(Contract AT(45-1)-1830)
(BNWL-SA-517; CONF-661020-8) CFSTI: HC$3.00/MF$0.65

A detector is described which is used along with howlers and visual annunciators in a warning system for uncontrolled nuclear criticality accidents. The detector is sensitive only to neutrons instead of to gamma rays which lower the probability of false alarms. NSA

N67-21578# Combustion Engineering, Inc., Windsor, Conn. Nuclear Div.
INPUT CARD LISTING FOR SAMPLE FLARE PROBLEM USED IN THE SETUP OF THE ISOCHECK METHOD FOR YANKEE CORE V
Richard Kern 28 Sep. 1966 13 p
(Contract AT(38-1)-428)
(CEND-271, Suppl. 1) CFSTI: HC$3.00/MF$0.65

The cards are for use with FLARE-code in determination of the heavy isotope content in the fuel for Yankee Core V at the beginning of the fuel cycle. NSA

N67-21583# General Electric Co., San Jose, Calif. Advanced Products Operation.
CALCULATED NUCLEAR REACTOR PARAMETERS AND THEIR UNCERTAINTIES IN A 1000 MWe FAST CERAMIC REACTOR
P. Greebler, C. L. Cowan, G. L. Gyorey, B. A. Hutchins, C. L. Fies et al Jul. 1966 26 p refs
(Contract AT(04-3)-189)
(GEAP-4471) CFSTI: HC$3.00/MF$0.65

Nuclear reactor parameters calculated for a 1000 MWe fast ceramic reactor in a design study are presented. An extensive survey was carried out to identify those uncertainties in nuclear data and calculational methods which are expected to have significant effects on the calculated reactor parameters. The effects of these uncertainties on safety and economic parameters are calculated using a simplified model of the reactor. The results show that favorable or unfavorable combinations of the uncertainties strongly influence the core design, and result in large differences in the safety and economic parameters. However, integral critical experiments tend to indicate that compensating errors occur and that the computed safety and economic parameters are probably accurate enough to form a reasonable basis for the evaluation of fast reactor designs. Some of the common assumptions used in cross section averaging are shown to have only a small effect on reactor design. Author (NSA)

N67-21631# General Electric Co., San Jose, Calif. Advanced Products Operation.
SOUTHWEST EXPERIMENTAL FAST OXIDE REACTOR DEVELOPMENT PROGRAM Quarterly Report, May–Jun. 1966
K. M. Horst, comp. Aug. 1966 98 p refs
(Contract AT(04-3)-540)
(GEAP-5208; QR-9) CFSTI: HC$3.00/MF$0.65

Preoperational research and development are summarized. Tasks scheduled for activity during the report period are discussed. Information is included on experimental program planning, fuel development, instrumentation, core assembly characteristics, reactivity controls, fuel handling, core design, fuel fabrication, and plant construction. NSA

N67-21632# General Electric Co., San Jose, Calif. Advanced Products Operation.
SODIUM-COOLED REACTORS FAST CERAMIC REACTOR DEVELOPMENT PROGRAM Quarterly Report, Feb.–Apr. 1966
Aug. 1966 112 p refs
(Contract AT(04-3)-189)
(GEAP-5158; QR-18) CFSTI: HC$3.00/MF$0.65

A program is being conducted to develop fast reactors using ceramic fuels, in particular mixed PuO_2–UO_2. Progress is reported for the following tasks: vented fuel development, transient testing of fuel, fuel performance evaluation, fast-flux irradiation of fuel, reactor physics and core analysis, and FCR cladding evaluation. NSA

N67-21639# Argonne National Lab., Ill.
CYCLOTRON ION SOURCE FOR THE GENERATION OF N^{5+} [TSIKLOTRONNYI ISTOCHUIK IONOV DLYA POLUCHENIYA N^{5+}]
B. N. Makov Nov. 1966 22 p refs Transl. into ENGLISH from the Russian Preprint IAE-1051, 1966 20 p
(ANL-TRANS-413; IAE-1051) CFSTI: HC$3.00/MF$0.65

An ion source was developed and tested for a cyclotron with a powerful heater-type cathode. Bench tests yielded an N^{5+}-current equal to 100 microampere, from a slit with the dimensions 2×20 mm^2. The cyclotron produced a current of accelerated N^{5+}-ions equal to 1.5 microampere with an energy of 105 MeV. Construction data are given for the ion source. Author (NSA)

N67-21640# Atomic Energy of Canada, Ltd., Chalk River (Ontario).
INTENSE NEUTRON GENERATOR
W. B. Lewis Oct. 1966 12 p
(AECL-2818; DL-72)

The economic and research contexts that would be served by producing neutrons in gram quantities at high intensities by electrical means without uranium-235 are discussed. The revenue from producing radioisotopes is attractive. The array of techniques introduced by the multipurpose 65 megawatt Intense Neutron Generator project includes liquid metal cooling, superconducting magnets for beam bending and focusing, superconductors for low-loss high-power radiofrequency systems, efficient devices for producing radiofrequency power, plasma physics developments for producing and accelerating hydrogen ions at high intensity that are still far out from established practice, a multimegawatt high voltage dc generating machine that could have several applications. The research fields served relate principally to materials science through neutron–phonon and other quantum interactions as well as through neutron diffraction. Nuclear physics is served through μ-, π- and K-meson production. Isotope production enters many fields of applied research. Author (NSA)

N67-21650# General Electric Co., Schenectady, N. Y. Knolls Atomic Power Lab.
CYCLIC STRESS LIMITS FOR BOLTS AND STUDS
R. J. Fritz 27 May 1966 36 p refs
(Contract W-31-109-ENG-52)
(KAPL-M-6561) CFSTI: HC$3.00/MF$0.65

A review is made of the fatigue characteristics of bolts and studs. It appears that the cyclic service stresses specified for bolts by the ASME Code for Nuclear Vessels (Section III, Paragraph N416) should be revised for several reasons. The nominal stress range is too conservative; the treatment of mean stress is unrealistic; and the increase of allowable fatigue load with a decrease in material ultimate strength is inconsistent with available data. New stress limits for bolts and studs are proposed and compared with data on 198 specimens. The proposal results in a minimum factor of safety on allowable stress range of 1.75 for these 198 specimens. The specimens included bolts and studs with the following properties: size 1" to 5-1/16"; AISI 4140 and 4340; ultimate strength 130 to 170 ksi; unplated and plated with, Cu, Ag on Ni, Ag, Cr, and Cd; rolled, ground, and machined and ground threads; machined and machined and rolled bolt head fillets. The approximate cycle range of failure was 3×10^3 to 5×10^5. The tests were at room temperature and at 500°F. Author (NSA)

N67-21664# Westinghouse Electric Corp., Pittsburgh, Pa. Atomic Power Div.
HIGH TEMPERATURE SUPERCRITICAL PRESSURE WATER LOOP. ADDENDUM I: DNB TESTS

J. Green Sep. 1966 15 p refs
(Contract AT(30-1)-2948)
(WCAP-2056; Addend1) CFSTI: HC$3.00/MF$0.65

A comparison of the departure from nucleate boiling (DNB) heat fluxes, measured on the SCOTT-R loop and Loop B, was made by the Thermal and Hydraulic Section of the PWR Plant Division, Westinghouse Atomic Power Divisions. Where a direct comparison between runs made in both loops was possible, an increased flow rate of 25% was required through the SCOTT-R loop to obtain comparable values of DNB heat flux, at the same pressure and inlet temperature, as on Loop B. Author (NSA)

N67-21687# Los Alamos Scientific Lab., N. Mex.
SYSTEM DYNAMICS FOR THE ULTRA HIGH TEMPERATURE REACTOR EXPERIMENT
H. B. Demuth, K. H. Duerre, F. P. Schilling, and C. E. Stiles 30 Nov. 1966 260 p refs
(Contract W-7405-ENG-36)
(LA-3561) CFSTI: HC$3.00/MF$0.65

A study of the Ultra High Temperature Reactor Experiment (UHTREX) system dynamics is described. A mathematical model of the system is developed and investigated with various digital computer programs. The results show that the UHTREX system can be operated safely at design conditions and over a wide range of off-design conditions. The system is stable and relatively insensitive to inaccuracies and changes in heat transfer coefficients. A startup route and a hot restart procedure for the UHTREX reactor are studied and found to be satisfactory. A variety of hypothetical system failures are investigated. It is shown that the overall system is safe from damage even in the event of serious equipment failures. Author (NSA)

N67-21682# Combustion Engineering, Inc., Windsor, Conn. Nuclear Div.
SETUP OF ISOCHECK METHOD FOR DETERMINING HEAVY-ISOTOPE CONTENT IN THE OPERATING FUEL ELEMENTS OF YANKEE CORE V
Michael F. Valerino, Zoltan R. Rosztoczy, and Richard Kern 30 Jun. 1966 76 p refs
(Contract AT(38-1)-428)
(CEND-271) CFSTI: HC$3.00/MF$0.65

Specific application of the ISOCHECK method to Yankee Core V is straight-forward in that no distortion of reactor geometry or serious compromises in the representation of core compositions are required. Two developmental fuel assemblies were included in the core loading of Yankee Core V. Inasmuch as these fuel assemblies constitute a very small fraction of the total core loading, their presence in the core was neglected; hence, no data were obtained on isotopic content in these two fuel assemblies. The degree of accuracy generally characteristic of the state of the art of reactor physics for water reactors should apply for the predominant remaining fuel assemblies in Yankee Core V (i.e., the recycled 4.1 wt % ^{235}U-enriched assemblies and the new 4.9 wt % ^{235}U-enriched assemblies). Accuracies of ±5% for ^{235}U depletion and of ±8% for total Pu content can be expected for normal batches of operating fuel elements in the reactor. The accuracies apply for the batch as a whole, which may consist of 20 or more fuel assemblies. The batch is the smallest unit of interest, insofar as isotopic content for fuel accounting purposes is concerned, because fuel reprocessing occurs in batch loads. Author (NSA)

N67-21689# Battelle Inst., Frankfurt Am Main (West Germany).
PRODUCTION AND INVESTIGATION OF CARBIDE HEATERS FOR A THERMIONIC CONVERTER OPERATING WITH NUCLEAR ENERGY, PART I [HERSTELLUNG UND UNTERSUCHUNG VON KARBIDISCHEN HEIZERN FUER EINEN MIT KERNENERGIE BETRIEBENEN THERMIONISCHEN KONVERTER. TEIL I.]
S. Janes, M. Kadner, H. G. Kling, D. Merz, W. Oberender et al Sep. 1966 52 p refs In GERMAN
(BMwF-FBK-66-28, Pt. 1) CFSTI: HC$3.00/MF$0.65

The preparation of different specimens, constructed analogous to nuclear heaters for thermionic converters to be prepared later on, is described. Hot pressing of ZrC-pelletized coated particles with UC_x-cermet gives useful specimens. Addition of Mo or Mo + C proved impractical. Author (NSA)

N67-21692# General Electric Co., San Jose, Calif. Advanced Products Operation.
USER REQUIREMENTS FOR CROSS SECTIONS IN THE ENERGY RANGE FROM 100 EV TO 100 KeV
P. Greebler and B. A. Hutchins Jun. 1966 37 p refs
(Contract AT(04-3)-189)
(GEAP-4472) CFSTI: HC$3.00/MF$0.65

The sensitivity of important physics parameters of large fast power reactors to uncertainties in the cross-section data between 0.1 and 100 keV was evaluated. Reactors using Pu–U and Th–U fuel cycles, carbide and oxide fuels, sodium and steam coolants, and a broad variation in neutron leakage and spectrum were considered. The cross-section accuracies required for calculations of fissile mass, breeding ratio, Doppler coefficient, and sodium void reactivity were determined. NSA

N67-21788# Atomics International, Canoga Park, Calif.
OPTIMUM LITHIUM HYDRIDE SHIELD VESSEL DESIGN FOR PROTECTION AGAINST METEOROID PUNCTURES
R. B. Schulz 10 May 1966 25 p
(Contract AT(11-1)-GEN-8)
(NAA-SR-MEMO-11790) CFSTI: HC$3.00/MF$0.65

A meteoroid puncture of a lithium hydride shield vessel will cause degradation of the neutron attenuation properties of the shield, primarily because of hydrogen loss. An analysis was made relating the increase in fast neutron dose rate due to shield vessel meteoroid puncture as a function of mission duration, exposed area, lithium hydride temperature, vessel thickness, and several other factors. The analysis further determines a minimum weight shield, which would consist of a reduced shield vessel thickness and a compensating increased lithium hydride length so that, at the end of the mission life, the design dose rate would be expected. It may result from this analysis that the minimum shield vessel thickness determined by structural requirements is sufficient for meteoroid protection. For shields with temperature gradients that would result in hydrogen loss in preferential areas, a compartmentalized shield is suggested so that these methods may be applied. A discussion of meteoroid protection for the SNAP-8 instrument rated shield is used for an example, and a comparison with the previous design method is included. The conclusion is that a large reduction in shield vessel thickness can be realized for lithium hydride shields by using this method of analysis. Author (NSA)

N67-21789# Eigenoessiches Institut fuer Reaktorforschung, Wurenlingen (Switzerland).
A SEMIEMPIRICAL METHOD FOR DETERMINATION OF THE NATURAL FLUX PLANE IN CONTINUOUS PLATES [EINE HALBEMPIRISCHE METHODE ZUR BESTIMMUNG DER NATUERLICHEN FLUSSGLAETTUNG BEI KONTINUIERLICHEM LADEN]
K. Junker and H. G. Hager Jun. 1966 20 p refs
(EIR-96) CFSTI: HC$3.00/MF$0.65

During reactor operation a natural flux flattening occurs through the irradiation of fuel elements. The flux form can be determined by means of numerical calculations with relatively large expenditure. A pure numerical method does not contribute very

much to the physical understanding of the problem. On this basis an analytical method was proposed and paralleled to it a second analytical method (the Lie series method) was discussed. Both methods are based on a one-group calculation which is sufficiently valid for optimization. Both methods were illustrated on an infinite plate reactor and it was shown that the first method is usable only in this case. The Lie series method is also usable for other geometries. Author (NSA)

N67-21791# Oak Ridge National Lab., Tenn.
ADJOINT MONTE CARLO CALCULATIONS FOR ENRICHED URANIUM METAL ASSEMBLIES
G. W. Morrison et al 1966 5 p refs
(Contract W-7405-ENG-26)
(K-DP-1637) CFSTI: HC $3.00/MF $0.65

The feasibility is demonstrated for obtaining multigroup adjoint Monte Carlo predictions of the multiplication constants for complicated geometries. NSA

N67-21792# Argonne National Lab., Ill.
1000-MW(E) METAL FUELED FAST BREEDER REACTOR
L. E. Link, J. E. Ayer, D. K. Butler, K. A. Hub, W. B. Loewenstein et al Jun. 1966 125 p refs
(Contract W-31-109-ENG-38)
(ANL-7001) CFSTI: HC $3.00/MF $0.65

A design study of a metal-fueled fast power breeder reactor was made to explore the burnup limits using a model with fuel elements that have sufficient void volume for expansion of gaseous fission products. A discharge burnup of 6% appears to be a reasonable limit, according to the model, for a somewhat degraded neutron spectrum with significant Doppler broadening and a breeding ratio of about 1.5. The expansion volume is suitable for including larger fractions of Ti or Zr in the fuel to take advantage of greater high-temperature strength of such fuel for possibly higher burnup with little adverse effect on neutronic performance. The fuel cycle results for a combined processing-fabrication plant located for simple shipment of low-decontamination fuel to three power plants, each of 1000-MW(e) capacity, are: an electric energy cost of somewhat under one mill per kW-hr; and a geometric doubling time for fissile Pu of 7.6 years. Author (NSA)

N67-21800# General Electric Co., Cincinnati, Ohio. Nuclear Materials and Propulsion Operation.
A MATERIALS, FABRICATION, AND DESIGN FEASIBILITY STUDY FOR A HIGH-TEMPERATURE, UNCOOLED, ARTICULATING CONTROL ROD
W. G. Baxter and J. W. Tenhundfeld 24 Jun. 1966 59 p refs Presented at the Am. Nucl. Soc. Meeting, Denver, 19–23 Jun. 1966
(Contract AT(40-1)-2847)
(GE-TM-66-6-23; CONF-660606-9) CFSTI: HC $3.00/MF $0.65

The results of a program to establish the materials criteria, preliminary design criteria and fabrication procedures for an uncooled articulating control rod are presented. Assumed conditions of operation includes contact with graphite in an inert atmosphere at 1000 to 1040°C (1800–1900°F) for thousands of hours. Involved in this program was the selection of materials, demonstration of the long term stability, fabrication techniques for the control materials, methods for joining the control rod segments to achieve articulation, and operational evaluation under environmental conditions. Author (NSA)

N67-21811# Oak Ridge National Lab., Tenn.
CALCULATING FUEL CYCLE COSTS FOR LIGHT WATER REACTORS
J. A. Lane [1966] 17 p Presented at the IAEA Intern. Survey Course on Econ. and Tech. Aspects of Nucl. Power, Vienna, 5–16 Sep. 1966
(Contract W-7405-ENG-26)
(ORNL-P-2532; CONF-660934-1) CFSTI: HC $3.00/MF $0.65

The techniques and principles involved in an evaluation of fuel cycle costs for light water reactors fueled with slightly enriched UO_2 are discussed. Estimated fuel cycle costs for boiling water reactors based on fabrication costs and warranted performance by the General Electric Company are given as an illustrative example. NSA

N67-21816# Oak Ridge National Lab., Tenn.
CRITICAL-PATH METHOD FOR SCHEDULING THE TRANSURANIUM PROCESSING PLANT: AN APPRAISAL
W. D. Burch and C. H. La Master Mar. 1966 44 p ref
(Contract W-7405-ENG-26)
(ORNL-3925) CFSTI: HC $3.00/MF $0.65

At the direction of the Atomic Energy Commission, the construction of the Transuranium Processing Plant was scheduled by the critical-path method (CPM) as a test of its usefulness in coordinating and expediting all phases of a major construction project. The use of CPM for the ORNL phases of the project is summarized, along with techniques used and major problems and advantages of this method in scheduling the design, procurement, fabrication, and installation of equipment. Coordination and scheduling of associated research and development programs were attempted with only limited success. To the members of the project, CPM appeared to have outstanding advantages over previous scheduling systems for a construction project. The fact that the basic project was completed very nearly on schedule (12/31/65) and well within the originally allotted funds can be at least partially attributed to the exacting scheduling required by CPM. The cost attributed directly to scheduling represented 1.3% of total funds expended on the project by the Laboratory. Specific methods used, and discussions of day-to-day management and supervisory uses of the technique are reported. Examples are given to show advantages in developing such schedules, their usefulness in alerting management to trouble spots, and the actions taken by management. Examples of failure to meet expectations are also cited. Author (NSA)

N67-21825# European Atomic Energy Community, Ispra (Italy). Reactor Physics Dept.
COMPARISON OF DIFFERENT METHODS FOR THE KINETICS OF AN ESSOR REACTOR TYPE
G. Forti, C. Rinaldini, and E. Vincenti Jul. 1966 14 p
(EUR-3051.E)

With the aim of investigating the kind of representation needed in the kinetics calculation of a reactor made up of three quite different regions, like the ESSOR reactor, three approaches were used: a point model method, a nodal method subdividing the reactor in three spatial regions, and a direct numerical solution of the time dependent diffusion equations. The results lead to the conclusions that, for a large category of transients, the point model is a good representation of the ESSOR reactor. Author (NSA)

N67-21832# Phillips Petroleum Co., Idaho Falls, Idaho. Atomic Energy Div.
FINAL DISASSEMBLY AND EXAMINATION OF THE ML-1 REACTOR CORE
T. L. Murphy, D. R. Schuyler, and W. L. Clarke, Jr. (Aerojet-Gen. Nucleonics) Jun. 1966 155 p refs
(Contract AT(10-1)-205)
(IDO-17190) CFSTI: HC $3.00/MF $0.65

The final disassembly and metallurgical examination of the ML-1 reactor were performed in the Test Area North (TAN) Hot Cell complex at the National Reactor Testing Station. This examination was conducted to find and identify the failure mechanism and leak paths which led to the reactor shutdown. The reactor core was disassembled remotely, and a visual inspection made of the reflectors, control rod shields, control blades, pressue tubes, and lower tube sheets. Also investigation of several outer liners from fuel elements was made. Tests conducted on the core structure and various components revealed a degeneration of the stainless steel pressure tubes and the bottom surface of the stainless steel lower tube sheet. Failure in 20 percent of the welds joining the pressure tube to the tube sheet (trepan welds) was detected by dye-penetrant and pressure tests. Metallurgical examinations were made on specimens from the defective areas to determine the cause of failure. These failures ranged from corrosion pitting to stress-corrosion cracking. Fuel element outer liners were observed to be failing by corrosion near the bottom of the element. The corrosion was promoted by precipitation of second phase material in the grain boundaries of the liner material weld and nose guide. The precipitating second phase was believed to be sigma type rather than complex carbides. Author (NSA)

23 PHYSICS, GENERAL

Includes acoustics, cryogenics, mechanics, and optics. For astrophysics see: 30 Space Sciences. For geophysics and related information see also: 13 Geophysics; 20 Meteorology; and 29 Space Radiation.

N67-20438# Johns Hopkins Univ., Baltimore, Md. Dept. of Physics.

PRECURSOR RADIATION IN ELECTROMAGNETIC SHOCK TUBES

Michael J. Scotto and Donald E. Kerr Sep. 1966 132 p refs (Contract Nonr-4010-19))

(TR-4; AD-641088) CFSTI: HC $3.00/MF $0.65

The purpose of the investigation was to determine the origin and magnitude of pre-excitation in a shock tube with a cylindrical geometry, and to determine whether a sufficient amount of energy is transferred to the cold gas to account for the observed discrepancies. Pre-excitation of the cold gas ahead of the main luminosity front was examined through spectroscopic analysis of optical precursor radiation and microwave measurements of the electron density. The populations of radiative excited states in a helium filled shock tube were determined from absolute intensity measurements of the precursor radiation. Estimates of the populations of metastable states were obtained from optical absorption measurements, and from measurements of optical radiation arising from a resonant transfer of excitation to an impurity gas. By measruring the spatial decrease of optical precursor light along the observation tube, it was possible to establish a model of pre-excitation in which energy is transferred to the cold gas through the absorption of ultra-violet radiation emitted from the discharge chamber. The production of optical precursor light is found to be consistent with a two-step process consisting of photo-ionization of the cold gas followed by excitation by electron impact. The results of the measurements also provided an upper limit to the populations of excited states. These results showed that only a small fraction of the cold gas is pre-excited. Author (TAB)

N67-20481 Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

COLLOID JOURNAL (SELECTED ARTICLES)

29 Jul. 1966 14 p refs Transl. into ENGLISH from Kolloidn. Zh. (Moscow), v. 27, no. 5, 1965 p 785–786; 731–734

(FTD-HT-66-301; TT-67-60276; AD-643929) CFSTI: $3.00

CONTENTS:

1. THE PREPARATION OF REPRODUCIBLE MONODISPERSE AEROSOLS WITH A MEAN PARTICLE RADIUS FROM 30 TO 300 A A. G. Sutugin p 1–3 refs (See N67-20482 10-06)

2. THE INTERACTION OF NEUTRAL AEROSOL PARTICLES IN A UNIFORM ELECTRICAL FIELD V. I. Nikitenko p 4–10 (See N67-20483 10-23)

N67-20483 Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

THE INTERACTION OF NEUTRAL AEROSOL PARTICLES IN A UNIFORM ELECTRICAL FIELD

V. I. Nikitenko *In its* Colloid J. (Selected Articles) 29 Jul. 1966 p 4–10 (See N67-20481 10-23) CFSTI: $3.00

To evaluate the forces of particle interaction, a study was made of an unlimited uniform electrical with strength $\bar{E}$ which contains a spherical dielectric particle of radius a_1. The medium of the particle is considered uniform and isotropic with a dielectric constant of ϵ_1. Designating the dielectric constant of the gaseous medium by ϵ_a and placing the origin of the coordinates at the center of the particle, an expression is obtained for the electrical field strength inside the particle in polar coordinates. Mathematical expressions are also derived for the second particle energy, and field strength inside the second particle. When neutral aerosol particles are in a uniform electrical field, ponderomotive forces of interaction between the particles arise, leading to coagulation of the aerosol. In evaluating the forces that determine the behavior of aerosol particles in electrical fields, consideration must be taken of the ponderomotive forces. R.U.

N67-20521*# Sylvania Electric Products, Inc., Mountain View, Calif.

BIREFRINGENT DEVICES Final Report, 8 Mar. 1966–8 Mar. 1967

E. O. Ammann and J. M. Yarborough 8 Mar. 1967 240 p refs (Contract NAS8-20570)

(NASA-CR-82880) CFSTI: HC $3.00/MF $0.65 CSCL 20F

CONTENTS:

1. INTRODUCTION 71 p refs (See N67-20522 10-23)

APPENDIXES

2. OPTICAL NETWORK SYNTHESIS USING BIREFRINGENT CRYSTALS. V: SYNTHESIS OF LOSSLESS NETWORKS CONTAINING EQUAL-LENGTH CRYSTALS AND COMPENSATORS E. O. Ammann and J. M. Yarborough 10 p refs (See N67-20523 10-23)

3. OPTICAL NETWORK SYNTHESIS USING BIREFRINGENT CRYSTALS. VI: ADDITIONAL TECHNIQUES FOR THE SYNTHESIS OF LOSSLESS DOUBLE-PASS NETWORKS E. O. Ammann and J. M. Yarborough 21 p refs (See N67-20524 10-23)

4. SYNTHESIS OF ELECTRO-OPTIC MODULATORS FOR AMPLITUDE MODULATION OF LIGHT E. O. Ammann and J. M. Yarborough 91 p refs (See N67-20525 10-23)

N67-20522*# Sylvania Electric Products, Inc., Mountain View, Calif.

INTRODUCTION

In its Birefringent Devices 8 Mar. 1967 71 p refs (See N67-20521 10-23) CFSTI: HC $3.00/MF $0.65

Both theory and experiments performed in the area of optical birefringent devices are reported. Theoretical work was performed in several areas. A generalization of the original birefringent network synthesis procedure is given which allows the synthesis of networks having asymmetric transmittances. This procedure increases the versatility of birefringent networks considerably at no expense in network complexity. In addition, a double-pass technique is described which can be used in connection with the synthesis procedure. This technique reduces by a factor of two the number of network components needed to realize most transmittances. Finally, procedures are given for synthesizing optical amplitude modulators having less distortion than conventional modulators. Experiments were performed on both single-pass and double-pass naturally birefringent networks. The results of these experiments provide the first direct verification of the single- and double-pass birefringent network synthesis procedures. In addition, distortion measurements were made on one- and three-stage amplitude modulators to verify the calculations mentioned above. Author

N67-20523*# Sylvania Electric Products, Inc., Mountain View, Calif.

OPTICAL NETWORK SYNTHESIS USING BIREFRINGENT CRYSTALS. V: SYNTHESIS OF LOSSLESS NETWORKS CONTAINING EQUAL-LENGTH CRYSTALS AND COMPENSATORS

E. O. Ammann and J. M. Yarborough *In its* Birefringent Devices 8 Mar. 1967 10 p refs Repr. from J. Opt. Soc. Am., v. 56, Dec. 1966 p 1748–1754 refs (See N67-20521 10-23) CFSTI: HC $3.00/MF $0.65

A brief review is given of a previous procedure for synthesizing birefringent networks having a prescribed amplitude transmittance in which the desired transmittance $C(\omega)$ was written in terms of C_i, where the C_i could be arbitrarily chosen as long as each was real. The synthesis procedure of this paper is a generalization of the above mentioned procedure and allows for the realization of $C(\omega)$ having complex C_i. The resulting network consists of n stages between an input and output polarizer, with each stage containing a birefringent crystal and (achromatic) optical compensator. The form of this netowrk is essentially the same as the practical form of the network obtained from the first method, so that the additional versatility is attained at no extra cost in network complexity. Author

N67-20524*# Sylvania Electric Products, Inc., Mountain View, Calif.

OPTICAL NETWORK SYNTHESIS USING BIREFRINGENT CRYSTALS. VI: ADDITIONAL TECHNIQUES FOR THE SYNTHESIS OF LOSSLESS DOUBLE-PASS NETWORKS

E. O. Ammann and J. M. Yarborough *In its* Birefringent Devices 8 Mar. 1967 21 p refs Submitted for publication (See N67-20521 10-23) CFSTI: HC $3.00/MF $0.65

Previous data on double-pass synthesis procedures, in which the light makes two passes through the network, are reviewed. Based on these data, additional procedures are given, which are applicable to a broader class of amplitude transmittances $C(\omega)$ when the number of network stages is odd. Two basic types of lossless birefringent network are discussed, and an equation is given for $C(\omega)$. Consideration is given to cases in which the coefficients are real and in which they are complex. L.E.W.

N67-20525* Sylvania Electric Products, Inc., Mountain View, Calif.

SYNTHESIS OF ELECTRO-OPTIC MODULATORS FOR AMPLITUDE MODULATION OF LIGHT

E. O. Ammann and J. M. Yarborough *In its* Birefringent Devices 8 Mar. 1967 91 p refs Submitted for publication (See N67-20521 10-23) CFSTI: $3.00

A technique is described which allows the synthesis of electro-optic amplitude modulators having arbitrary modulation characteristics. The synthesized modulator consists of a series of cascaded stages between an input and output polarizer. Each stage contains an electro-optic material and an optical compensator. The number of stages depends on the complexity of the desired voltage transfer function K(v). The transfer function of an ideal amplitude modulator is discussed as well as methods of approximating it. Two cases are considered: the use of envelope detection and the use of square-law detection. It is pointed out that best results were obtained for both the envelope and square-law cases by writing the fundamental and harmonic amplitudes as power series in V. The coefficients were chosen to eliminate as many nonlinear terms from the fundamental expression and as many low-order terms from the second harmonic expression as possible. L.E.W.

N67-20626# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

THE LEADER OF UNDER WATER LIGHTNING

14 Jul. 1966 5 p Transl. into ENGLISH from Komsomol'skoye Znamya (USSR), 18 Nov. 1964 p 1

(FTD-HT-66-384; AD-644798) CFSTI: HC $3.00/MF $0.65

The unexpected force of the shock wave that arises during a momentary electrical discharge in a liquid changes the form of details, shapes them and cuts complex holes and channels in the hardest materials in the course of several seconds. The electrodes are connected with a thin wire. If a sufficiently powerful current source is connected to the electrodes, then the wire, like a fuse, melts and vaporizes in an insignificant fraction of a second. But the path of the discharge has already been designated and a powerful impulse of electrical current, the magnitude of which can be regulated by changing the voltage of the source or adding resistance, jumps across the electrodes. By bending the wire or replacing it with a tape or a tube, we can obtain a lightning of any form: circular, spiral or zig zag. Then the electrohydraulic shock is directed to the necessary place. The wire can even be bent along the contour of the detail and then the detail will receive a stamping blow simultaneously from all sides, as occurs in a hydraulic press. TAB

N67-20700# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

SELECTED WORKS OF K. E. TSIOLKOVSKIY

B. N. Vorob'yev and V. N. Sokol'skiy, ed. 5 May 1966 758 p refs Transl. into ENGLISH of the book "Konstantin Eduardovich Tsiolkovskii: Izbrannye Trudy" Moscow, Izd. Akad. Nauk SSSR, 1965 p 1–535

(FTD-MT-64-241; TT-67-60327; AD-644143) CFSTI: HC $3.00/MF $0.65

The volume includes the basic works of Tsiolkovskii on aviation, aerodynamics, rocket technology and interplanetary communication. TAB

N67-20712# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

NEW PRINCIPLES OF CONSTRUCTION OF THE PHYSICAL THEORY

A. A. Yefimov 30 Aug. 1966 87 p refs Transl. into ENGLISH from Izv. Glavnoi Astron. Observ. (Pulkovo), v. 23, no. 2, 1963 p 118–151

(FTD-MT-65-37; AD-643962) CFSTI: HC $3.00/MF $0.65

The purpose of the work is to show the heuristic force of the basic laws of nature, if a new energy content is imparted to them. TAB

N67-20717# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
APPROXIMATE CALCULATION OF THE DYNAMICS OF ELECTRONS IN AN INJECTOR-BUNCHER
V. F. Gass 21 Nov. 1966 18 p refs Transl. into ENGLISH from Inzh.-Fiz. Inst., Uskoriteli (Moscow), no. 5, 1963 p 45–54
(FTD-MT-65-488; AD-643981) CFSTI: HC $3.00/MF $0.65

The injector-buncher consists of two cylindrical resonators located side-by-side. Oscillations of type E sub 010 are excited in the resonators. A cold-cathode (field-emission cathode) is located in the first resonator. A sharp pulse of current occurs during one complete cycle of high-frequency oscillation. The paper proves that by using certain assumptions during the solution of the equations of motion of the electrons in the resonators, a qualitative and quantitative study can be made of the bunching properties of the considered device without resorting to numerical integration of the equation of motion. Author (TAB)

N67-20786# Illinois Univ., Urbana. Dept. of Physics.
DILUTE SOLUTIONS OF He^3 IN He^4 AT LOW TEMPERATURES
David Pines and John C. Wheatley [1966] 33 p refs Presented at the 10th Intern. Conf. on Low Temp. Phys., Moscow, Sep. 1966
(Contracts AT(11-1)-1198; DA-31-124-ARO(D)-114)
(COO-1198-392; CONF-660816-7) CFSTI: HC $3.00/MF $0.65

Measurements were made at saturated vapor pressure of the heat capacity of dilute solutions of concentrations 1.3% and 5.0% ^{3}He down to temperatures well below 10 m°K. No evidence for phase separation was observed. The idea that the ^{3}He quasiparticles in the ^{4}He at low temperatures constituted a weakly interacting Fermi fluid was confirmed. Results of the measurements are described. NSA

N67-20790# Illinois Univ., Urbana. Dept. of Physics.
HEAT CAPACITY OF DILUTE SOLUTIONS OF LIQUID He^3 IN He^4 AT LOW TEMPERATURES
William Ronald Roach (Ph.D. Thesis) Aug. 1966 103 p refs
(Contract AT(11-1)-1198)
(COO-1198-383) CFSTI: HC $3.00/MF $0.65

Heat capacity measurements were made on two dilute solutions of liquid ^{3}He in ^{4}He. These data, taken under saturated vapor pressure at temperatures between 0.005 and 0.20°K, are characteristic of an ideal Fermi gas with m^* (effective mass of ^{3}He quasiparticle) dependent only slightly on concentration. The solution with a molar concentration of ^{3}He of 1.32 ± 0.01% had a degeneracy temperature of 0.141 ± 0.002°K and m^*/m = 2.38 ± 0.04. For the solution with a 5.02 ± 0.03% concentration of ^{3}He, the degeneracy temperature was 0.331 ± 0.004°K while m^*/m = 2.46 ± 0.04. The slight dependence of m^* on concentration can be explained in terms of the Landau theory of a Fermi liquid. The perturbation method, which Bardeen, Baym, and Pines used to determine an effective potential v(q) between ^{3}He quasiparticles from later data on the magnetic properties of these solutions, was used to estimate the low-temperature contribution of the ^{3}He quasiparticles to the thermal conductivity and viscosity of dilute solutions. Author (NSA)

N67-20796# India. Dept. of Atomic Energy, Bombay.
REFLECTIVITIES OF SOME METALLIC CRYSTALS USED IN NEUTRON SPECTROMETERS
K. R. Rao 1966 29 p refs
(AEET-259)

Neutron crystal spectrometers make use of several metallic single crystals like aluminum, copper, or lead for providing monochromatic neutron beams or for use as analyzers. The efficiency of several planes of these crystals for such purposes is presented in the reflection and transmission geometries. Tables of absolute and effective reflectivities are given. Author (NSA)

N67-20813# Illinois Univ., Urbana. Dept. of Physics.
PROPAGATION OF ZERO SOUND IN LIQUID He^3
William Russell Abel Aug. 1966 67 p refs
(Contract AT(11-1)-1198)
(COO-1198-384) CFSTI: HC $3.00/MF $0.65

The propagation of sound in liquid He^3 was observed at a pressure of 0.32 atm and at frequencies of 15.4 and 45.5 MHz down to a temperature T^* of 2m°K (1m°K = 10^{-3}°K) on the temperature scale valid for the Curie-law magnetic susceptibility of powdered cerium magnesium nitrate in the form of a right circular cylinder with diameter equal to height (T^* is magnetic temperature of powdered CMN). The results of the measurements have been published. As the temperature was increased, the sound attenuation increased, went through a maximum, and then decreased. At low temperatures, the attenuation was proportional to T^{*2} but independent of frequency, and at higher temperatures it was proportional to ω^2/T^{*2}, where ω is the angular frequency of the sound. The temperature at which maximum attenuation occurred was 11.3m°K for the frequency of 15.4 MHz and was 19.3m°K for 45.5 MHz. The velocity of the sound was found to be relatively temperature independent at high and low temperatures but near the attenuation maximum the velocity changed by 3.5±0.3%. The results of the measurements are predicted by the Landau theory of a Fermi liquid, the velocity change and the temperature dependence of the attenuation coefficient at low temperatures being explained by the propagation of a new mode of sound, called zero sound. The velocity change is in quantitative agreement with the theory. The attenuation of zero sound is about 35% larger than that predicted by theory, but could be explained by a shorter collision time between quasiparticles in the zero sound regime. The frequency and temperature dependence of the attenuation coefficient at higher temperatures are those predicted for ordinary hydrodynamic sound. Author (NSA)

N67-20828# Brookhaven National Lab., Upton, N. Y. Accelerator Dept.
MAGNETIC MATERIALS IN TWO-DIMENSIONAL FIELDS
Richard A. Beth 19 Aug. 1966 8 p
(Contract AT(30-2)-GEN-16)
(BNL-10587; AADD-119) CFSTI: HC $3.00/MF $0.65

A report is presented in order to formulate and illustrate a complex magnetic interface theorem for treating two-dimensional magnetic fields at a cylindrical interface between media of differing permeability. The interface theorem, like the analogous current sheet theorem of AADD-102, is useful for treating two-dimensional field problems by exploiting the theory of functions of a complex variable. NSA

N67-20832# Massachusetts Inst. of Tech., Cambridge. Research Lab. of Electronics.
NO TITLE Quarterly Progress Report
H. J. Zimmermann and George G. Harvey 12 Jul. 1966 309 p refs
(Contract AT(30-1)-3581)
(RLE-QPR-82; TID-23318) CFSTI: HC $3.00/MF $0.65

Research results are reported on general physics in terms of molecular beams, molecular collisions, microwave spectroscopy, radio astronomy, solid-state microwave electronics, optical and infrared spectroscopy, noise in electron devices, physical electronics and surface physics, physical acoustics, and electrodynamics of moving media. NSA

N67-20995# Los Alamos Scientific Lab., N. Mex.
PULSED FIELD SKIN EFFECT CALCULATIONS FOR CYLINDRICAL CONDUCTORS
D. A. Baker, M. D. J. MacRoberts, and L. W. Mann 14 Sep. 1966 99 p
(Contract W-7405-ENG-36)
(LA-3500) CFSTI: HC $3.00/MF $0.65

Calculations are described of pulsed magnetic field penetration into cylindrical conductors. A computer code was developed which calculates magnetic field penetration, surface electric field, and resistive damping in a capacitively driven RLC circuit including effects of a time varying skin depth. A set of dimensionless curves is given which allows one to estimate these factors. Generalizations of the method are discussed and an example is given. Author (NSA)

N67-21003# Atomic Weapons Research Establishment, Aldermaston (England).
A PROGRAMME TO EVALUATE THE CURRENT DENSITY FROM A METAL GIVEN WORK FUNCTION, TEMPERATURE, AND ELECTRIC FIELD
W. McDonald Aug. 1966 27 p refs
(AWRE-O-50/66) HMSO: 4s

A method used to compute electron emission in an electric discharge, from the general electron emission equation, is described. Results are given in tabular and graphical form. Author (NSA)

N67-21031# New York Univ., N. Y.
LOW TEMPERATURE PROPERTIES OF LIQUID He^3
A. E. Glassgold *In* Brookhaven Natl. Lab. Inelastic Scattering of Neutrons by Condensed Systems Mar. 1966 p 69–77 refs (See N67-21022 10-24) CFSTI: HC $3.00/MF $0.65

A review will be presented of simple theoretical concepts and current experimental results on the properties of liquid helium-3 at low temperatures and low pressures. Some of the topics to be covered are the extent of experimental confirmation of Landau's theory of the Fermi liquid; the possible transition into a superfluid phase; the observation of zero sound; and the importance, and present difficulties, in "microscopic" probing of the elementary excitations. Author (NSA)

N67-21047# State Univ. of New York at Buffalo.
THE DISPERSION RELATION IN LIQUID HELIUM
Lyle B. Borst *In* Brookhaven Natl. Lab. Inelastic Scattering of Neutrons by Condensed Systems Mar. 1966 p 173–174 ref (See N67-21022 10-24) CFSTI: HC $3.00/MF $0.65

The normal mode description of the excitations in liquid helium gives a complete description of the thermodynamic properties. In this representation the normal modes are among a set of diatomic rotors with nearest-neighbor spacings. The ground state (Dehye liquid) is a substrate in which the excitations appear as a distinguishable component. The lambda point is the temperature at which no molecules remain in the ground state. In the dispersion relation the lambda point is related to the minimum by the equality $kT_\lambda = c_2\rho_0$. Beyond ρ_0 only phonons are excited, since the diatomic systems have dissociated. The dispersion curve below ρ_0 represents initially phonon excitations supplemented by normal mode excitations among the diatomic rotors. Author (NSA)

N67-21096# Kernforschungsanlage, Juelich (West Germany). Zentralbibliothek.
LOW-TEMPERATURE TECHNOLOGY. FACILITIES AND CONSTRUCTION MATERIALS FOR CONDUCTION, TRANSPORT AND STORAGE OF LIQUID HYDROGEN. LOW-TEMPERATURE PROPERTIES OF METALS, ALLOYS, AND NON-METALLIC MATERIALS—A BIBLIOGRAPHY [TIEFTEMPERATURTECHNIK. ANLAGEN UND BAUELEMENTE FUER LEITUNG, TRANSPORT UND LAGERUNG, SPEZIELL VON FLUESSIGEM WASSERSTOFF, SOWIE TIEFTEMPERATUREIGENSCHAFTEN VON METALLEN, LEGIERUNGEN UND NICHTMETALLISCHEN WERKSTOFFEN. EINE LITERATURZUSAMMENSTELLUNG]
E. Paul, M. Wittenberg, and E. Freyschmidt Sep. 1964 64 p refs In GERMAN and ENGLISH
(JUL-BIBL-4) CFSTI: HC $3.00/MF $0.65

This literature survey covers cryogenic facilities and structural materials to be used for the ductwork, transportation, and storage of liquid hydrogen. Also included are low temperature properties of metals, alloys, and nonmetallic materials. Author

N67-21359# Ballistic Research Labs., Aberdeen Proving Ground, Md.
EXPLICIT INTEGRAL SOLUTION OF THE INITIAL VALUE PROBLEM IN ACOUSTICS FOR PAST AND FUTURE TIMES
Abdul R. Kiwan Aug. 1966 18 p refs
(BRL-R-1334; AD-644614) CFSTI: HC $3.00/MF $0.65

Explicit solution of the initial value problem for an acoustical disturbance has been given in two dimensions by Diaz and Landshoff, for times $t < 0$, besides $t > \text{or} = 0$. The present report extends the results to three dimensions, using a different method to construct the solution. The two dimensional solution is deduced by Hadamards method of descent. The conditions imposed on the initial data to insure the existence and uniqueness of the solution are weaker than those of Diaz and Landshoff. Author (TAB)

N67-21363# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
OPTICAL RESONATOR
V. K. Ablekov 9 Sep. 1966 7 p refs Transl. into ENGLISH from Soviet Patent no. 176329 (Appl. no. 880471/26-25, 6 Feb. 1964) 2 p
(FTD-HT-66-109; AD-644043) CFSTI: HC $3.00/MF $0.65

The object of the invention is an optical resonator, consisting of two prisms set with their bases at the Brewster angle to the axis of the resonator. To remove the reflection losses and to obtain discrete magnitudes of the dispersion and of the necessary length of the path of rays of open circulation inside the resonator, one of the prisms is made in the form of a converted tripole with the angle between the base and one of the faces equal to the Brewster angle, the second is made in the form of a multilateral pyramid with an even number of faces, the opposite faces being mutually perpendicular, with equal angles at the apex and with the plane of the base set at the Brewster angle to the axis of symmetry of the pyramid, and the angle between one face and the base must be within limits of alpha-(alpha + pi/2k), where alpha is a constant that depends upon the selection of the face; 2k is the number of faces of the pyramid. Author (TAB)

N67-21438# Massachusetts Univ., Amherst. Polymer Research Inst.
THE SCATTERING OF LIGHT BY DEFORMED THREE-DIMENSIONAL SPHERULITES

J. J. van Aartsen 1 Mar. 1966
(Contract Nonr-3357(01))
(ONR-TR-83; AD-644105) CFSTI: HC $3.00/MF $0.65

The report gives an account of some theoretical calculations, based upon two different affine transformation models, as described previously. The preliminary results for two dimensional, disc-like spherulites are now extended to the three dimensional case and at the same time reorientation of the crystallites inside the spherulite is included. Although the calculations are carried out for the case of the stretching direction coinciding with the direction of polarization of the incident beam, the calculations are set up more generally and from the formulas derived in this report one can easily perform the calculations for the case that the stretching direction makes a certain angle psi with the polarization direction of the incident beam. The theory in this report is developed for non-ringed spherulites, that is, spherulites in which no regular helicoidal twisting of the crystallites around the spherulite radius occurs. We can, however, on the same basis develop equations for ringed spherulites. Light scattering intensity contours are presented for various combinations of the spherulitic parameters. Author (TAB)

N67-21542# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy.
ELECTROMAGNETIC WAVE SCATTERING WITH A DIPOLE CENTER SYSTEM [RASSEYANIE ELECTROMAGNITNYKH VOLN NA SISTEME DIPOL'NYKH TSENTROV]
V. L. Lyuboshits 1966 20 p refs In RUSSIAN Submitted for publication
(JINR-P-2896)

The problem of the electromagnetic wave scattering with two stationary dipole centers is solved. A system of algebraic equations is obtained, which determines the electromagnetic wave scattering amplitude with the system consisting of an arbitrary number of dipole centers. This system is generalized to the case of macroscopic medium with chaotic and uniform distribution of the scattering centers. The resonance frequency shift and the resonance width change are considered for the electromagnetic wave scattering in the macroscopic medium. Author (NSA)

N67-21563# Brookhaven National Lab., Upton, N. Y. Accelerator Dept.
GENERAL CONDITIONS FOR ACHIEVING PHASE SHIFTS OF π AND 2π BY MEANS OF QUADRUPOLE MULTIPLETS
E. Regenstreif 24 Oct. 1966 21 p refs
(Contract AT(30-2)-GEN-16)
(BNL-10813; AADD-124) CFSTI: HC $3.00/MF $0.65

The general theory is given for formulating analytic conditions for achieving phase shifts of π and 2π by means of magnetic multiplets (mainly quadruplets, quintuplets, and sextuplets) composed of quadrupoles. The thick lens approach is used throughout, and no use is made of the thin lens approximation. NSA

N67-21596# California Univ., Livermore. Lawrence Radiation Lab.
NUMERICAL SOLUTION OF MAGNETIC FIELD BOUNDARY-VALUE PROBLEMS
John Killeen and Shirley L. Rompel 1 Sep. 1966 30 p refs
(Contract W-7405-ENG-48)
(UCRL-50127) CFSTI: HC $3.00/MF $0.65

The Fortran program BETA is described. It is suitable for the numerical solution of second-order differential equations of either parabolic or elliptic type in two dimensions. The solution is by finite difference methods using an alternating-direction implicit scheme. Applications to several boundary-value and initial-value problems are given. Particular emphasis is given to solving magnetic field problems in cylindrical coordinates. Author (NSA)

N67-21662# Columbia Univ., New York.
TEST OF TIME-REVERSAL INVARIANCE IN ELECTROMAGNETIC INTERACTIONS USING THE MOESSBAUER EFFECT
M. Morita [1966] 13 p refs
(Contract AT(30-1)-1932)
(NYO-1932-114) CFSTI: HC $3.00/MF $0.65

Possible time reversal experiments for electromagnetic interactions using the Moessbauer effect and parity experiments in nuclear states are discussed. The idea is the following. With observing electromagnetic subtransitions in nuclear gamma decays where the magnetic quantum numbers of the initial and final states are known with the Moessbauer absorption lines, and ensemble of oriented nuclei are dealt with the emitter so that this kind of nuclear orientation is useful for P and T experiments in beta decays. NSA

N67-21686# Oak Ridge National Lab., Tenn.
WEAK, PLANE BLAST WAVES
Lawrence Dresner 1 Dec. 1966 23 p refs
(Contract W-7405-ENG-26)
(ORNL-TM-1703) CFSTI: HC $3.00/MF $0.65

Theory is developed for a weak explosion in a homogeneous atmosphere and in an isothermal atmosphere in a gravitational field. Graphs of overpressure vs distance are given. NSA

N67-21687# Oak Ridge National Lab., Tenn.
STRONG, PLANE SHOCK WAVES IN AN INHOMOGENEOUS ATMOSPHERE
Lawrence Dresner 1 Dec. 1966 19 p refs
(Contract W-7405-ENG-26)
(ORNL-TM-1702) CFSTI: HC $3.00/MF $0.65

Theory is presented for the propagation of strong shocks produced by explosions. First, propagation in a homogeneous atmosphere is considered, and then the inhomogeneous atmosphere without and with gravity is treated. Equations are derived for the overpressure and position of the shocks. It is concluded that for air, the effects of gravity can be neglected in the strong-shock region. NSA

N67-21711# California Univ., Berkeley. Div. of Applied Mechanics.
ON CIRCULARLY-POLARIZED NONLINEAR ELECTROMAGNETIC WAVES
M. M. Carroll Aug. 1966 19 p refs
(Contract Nonr-222(69))
(AM-66-11; AD-644184) CFSTI: HC $3.00/MF $0.65

An exact solution of the nonlinear electromagnetic equations for a conservative nondispersive isotropic centro-symmetric dielectric is obtained, which has an especially simple form, i.e., a harmonic, circularly-polarized plane progressive wave. The normal incidence of such a wave at a plane interface is considered and also the propagation of such waves in a transversely isotropic, uniformly magnetized material. Author (TAB)

N67-21713# Texas Univ., Austin. Center for Relativity Theory.
A THEORY OF GRAVITATION
P. Rastall (Brit. Columbia Univ.) Repr. from Nuovo Cimento (Bologna), v. 42, Ser. 10, Mar. 1966 p 13–37 refs Prepared in part at Graduate Res. Center of the Southwest
(Grant AF-AFOSR-454-64)
(AFOSR-66-2083; AD-642884) CFSTI: HC $3.00/MF $0.65

A theory of gravitation is developed which is a natural generalization of the Newtonian theory and of special relativity. Space-time is Riemannian, but its metric is determined by a scalar function phi, the analogue of the Newtonian potential. The functional dependence of the metric tensor on phi is deduced, apart from two constant parameters, from the hypothesis that no measurement in an isolated region of space-time can determine whether the potential in that region is phi or phi + K, where K is any constant. Test particles are assumed to travel along geodesics, and one of the unknown parameters in the metric tensor is fixed by requiring that the motions of test particles should have the correct classical limit. The usual expression for the gravitational red-shift then follows. The action of a system of gravitationally interacting particles is found. A field equation is obtained for phi, and an energy-momentum tensor for the whole system. The remaining undetermined parameter in the metric tensor is fixed by requiring that in the static case phi depend linearly on the energy density of the sources. New units of mass, length, and time are introduced, in terms of which many equations of the theory become identical in form with the corresponding special relativistic equations. Conservation laws for energy and momentum hold when these quantities are expressed in the new units. The principle of equivalence is discussed. Author (TAB)

N67-21721# California Univ., Berkeley. Div. of Applied Mechanics.
A THEORY OF MIXTURES
A. E. Green and P. M. Naghdi Sep. 1966 53 p refs
(Contract Nonr-222(69))
(AM-66-13; AD-644186) CFSTI: HC $3.00/MF $0.65

The paper is concerned with a dynamical theory of mixtures, composed of n reactive constituents in relative motion to each other. The theory is developed in terms of the constituent ingredients using a balance of energy and an entropy production inequality for each constituent of the mixture, together with invariance requirements under superposed rigid body motions of the whole mixture. The balance of energy and the entropy production inequality for each of the constituents, which include contributions arising from interactions, combine to yield a single energy equation and a single entropy production inequality in terms of the ingredients of the mixture as a whole; the relations between the thermodynamical variables of the mixture and those of its constituents depend, in general, on the past history of the temperature and the kinematic variables. Full thermodynamical restrictions are deduced, and the theory is applied to the special case of a mixture of two ideal fluids. Author (TAB)

N67-21729# Polytechnic Inst. of Brooklyn, N. Y.
EFFECT OF THE PLOTTING PARAMETER "K" UPON LIGHT SCATTERING RESULTS
Michel Boeel and Frederick Eirich Oct. 1966 81 p refs
(Contract Nonr-839(32) FBM)
(PIBAL-913; AD-643718) CFSTI: HC $3.00/MF $0.65

The optimization of the Zimm grid fit, as applied to the scattering of light from dilute polymer solutions, is discussed as a function of the plotting parameter k. The characteristic parameters of the polymer and of its solution are relatively insensitive to the choice of k; however, it is shown by a detailed error analysis, that a theoretically predictable value of k minimizes the ratio of a function of error of the independent variable (a linear combination of the concentration and of a function of the scattering angle) to the same function of error of the dependent variable (the reciprocal intensity function). Optimal fit is obtained by choosing a value of the plotting parameter k such that, on the average, the error committed on the independent variable is less than one percent of that committed on the dependent variable. It is thus shown that k is not arbitrary, but that a predictable value can optimize the fit of the grid. Author (TAB)

N67-21747# Eidgenossische Technische Hochschule, Zurich (Switzerland).
ON THE OPTICAL ACTIVITY IN THE INFRARED [UEBER DIE OPTISCHE AKTIVITAET IM INFRAROT]
Hansruedi Wyss (Ph.D. Thesis) 1965 76 p refs In GERMAN
(Rept.-3731) CFSTI: HC $3.00/MF $0.65

A mathematical discussion is presented on the theory of optical activity in the infrared region. The quantum mechanics theory of optical activity and the perturbation calculation are outlined with regard to the derivation of an expression for the rotation strength of vibration transitions. An automatic infrared spectral polarimeter, using the double modulation method, is described. Technical instruments and techniques are outlined, and pertinent graphics included. The experimental work is considered noteworthy for the accurate measurement of the Cotton effect vibration. Transl. by R.U.

N67-21780# Tokyo Univ. (Japan). Inst. of Industrial Science.
EFFECTS OF AMPLITUDE FILTERS ON THE DIFFRACTION IMAGE AND THE MARECHAL'S ABERRATION TOLERANCE CONDITIONS
Toshimitsu Asakura Repr. from Rept. Inst. Ind. Sci. Univ. Tokyo (Japan), v. 17, no. 2, Dec. 1966 p 51–76 refs *Its* Serial no. 109
CFSTI: HC $3.00/MF $0.65

A simple form of nonuniform amplitude filter is proposed to study effects of amplitude filters on the three-dimensional intensity distribution and the Marechal's aberration tolerance conditions. Fraunhofer diffraction patterns obtained with this filter are investigated with regard to the diffraction patterns on the focal plane and the optical transfer function of the slit aperture. Examined are the effects of nonuniform amplitude aperture illumination on the three-dimensional intensity distribution in the neighborhood of focus of an optical system. Intensity distributions are calculated numerically by the 24-point Gaussian quadrature method with an electronic computer. Diagrams of the contour lines of intensity (isophotes) in the aberration-free system with the circular aperture are presented. Results show a close relation between the nonuniform amplitude aperture illumination and the Marechal aberration tolerance values. The maximum value of aberration tolerance for a given nonuniform amplitude filter is shown, as well as the form of the aperture filter that is optimum for use. S.P.

24 PHYSICS, ATOMIC, MOLECULAR, AND NUCLEAR

Includes atomic, molecular, and nuclear physics. For applications see: 22 Nuclear Engineering. For related information see also: 29 Space Radiation.

N67-20388 Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
EMISSION SPECTRA OF RAREFIED MOLECULAR GASES EXCITED BY FAST ELECTRONS
A. G. Koval', V. T. Konne, and Ya. M. Fogel' *In its* Cosmic Res. 23 Jun. 1966 p 120–143 refs (See N67-29381 10-30)
CFSTI: $3.00

Nitrogen emission spectra excited by an electron beam with energies from 0.1–20 keV and those of oxygen and air excited by electrons with an energy of 13 keV are investigated in the visible region. An estimate is made of the relative intensities of the various emissions in each spectrum. For nitrogen, the

dependence of the relative intensities of the various emissions on the energy of the electrons is studied in the range from 0.1–20 keV. The N_2, O_2, and air spectra excited by electrons are compared with the spectra of the same gases excited by protons with an energy of 37 keV, and with the auroral spectra. Author

N67-20406# United Kingdom Atomic Energy Authority, Risley (England).
ESTIMATION OF THE ACTIVITY CONTENT IN CURIES OF RADIOACTIVE MATERIALS FOR TRANSPORT PURPOSES
A. E. Shaw 1966 56 p refs
(TRG-1287(D)) HMSO: 5s 6d

This report discusses the problems that arise when it is required to estimate the curie content of radioactive materials to be transported under the auspices of regulations such as have been put forward by the International Atomic Energy Agency. Estimations by calculation and from external radiation measurements are discussed, and some of the practical uncertainties that arise in each case are explored. The general conclusion is that the estimate of curie content is not very precise, and probably does not need to be. Author

N67-20421*# Wisconsin Univ., Madison. Theoretical Chemistry Inst.
THE ENERGY OF INTERACTION BETWEEN TWO HYDROGEN ATOMS BY THE GAUSSIAN-TYPE FUNCTIONS
J. O. Hirschfelder and Hojing Kim 28 Feb. 1967 20 p refs
(Grant NsG-275-62)
(NASA-CR-83049; WIS-TCI-222) CFSTI: HC $3.00/MF $0.65
CSCL 07D

The interaction of two hydrogen atoms in their ground states is investigated with a Hirschfelder–Linnett type of wave function in which the exponentials are replaced by Gaussian-type functions. It is found that the long-range interaction is not properly described, but that a reasonable approximation results for the molecular energy near the equilibrium separation. The explicit formulas for the atomic integrals are tabulated. Author

N67-20479# Instituto de Investigacion Aeronautica y Espacial, Buenos Aires (Argentina).
PHENOMENOLOGICAL AND MICROSCOPIC ANALYSIS OF PROPERTIES OF EVEN-EVEN NUCLEI. PART C: MICROSCOPIC MODELS
C. A. Heras (La Plata Univ.), S. M. Abecasis, and H. E. Bosch Mar. 1966 236 p refs *Its* Ser. de Comun. LR9
(Grant DA-ARO-49-092-65-G78)
(AD-641192) CFSTI: HC $3.00/MF $0.65

Partial contents: Residual interactions; (The pairing force. The quadrupole-quadrupole force. Special interactions. General central interactions); Methods of the theory of groups; (The SU3 classification scheme. General technique. Application to pairing interactions. Comparison with experiment); Particle-hole interaction; The interacting-quasiparticle picture; (The Hartree-Fock-Bogoliubov method. The independent-quasiparticle approximation. Charge-independent pairing correlations. Quasiparticle interactions. The quasiboson approximation. The cranking model approach); Microscopic description of properties of medium weight and heavy nuclei; (Two-quasiparticle states. Vibrations. Rotational modes. Deformations); More about the interacting quasiparticle picture; (The Green function technique. Analysis of the particle-number non conservation. Higher approximations. Extensions of the Hartree-Fock-Bogoliubov method). TAB

N67-20485# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
UKRAINIAN JOURNAL OF PHYSICS (SELECTED ARTICLES)
27 Sep. 1966 12 p refs Transl. into ENGLISH from Ukr. Fiz. Zh. (Kiev), v. 10, no. 3, 1965 p 260–262; 346–348
(FTD-HT-66-175; AD-644800) CFSTI: HC $3.00/MF $0.65

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2. FOR THE EXCITATION OF WAVES IN LIMITED PLASMA BY A MODULATED STREAM A. M. Kondratenko p 5–8 refs (See N67-20487 10-25)

N67-20486# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
OBTAINMENT OF ACCELERATED BEAMS OF POSITRONS FOR LINEAR ACCELERATION OF ELECTRONS
I. O. Grishayev and A. S. Litvinenko *In its* Ukrain. J. of Phys. (Selected Articles) 27 Sep. 1966 p 1–4 refs (See N67-20485 10-24) CFSTI: HC $3.00/MF $0.65

A description is given of the results of preliminary experiments on obtaining accelerated positron beams on a linear electron accelerator. The conversion factor of electrons into positrons is found to equal $2 \cdot 10^{-6}$ positron/electron at maximum spectra, which gives $1.03 \cdot 10^{6}$ positrons per pulse over an energetic range of ±10%. Author

N67-20634# Naval Radiological Defense Lab., San Francisco, Calif.
RANGE AND DEPTH DOSE DISTRIBUTION OF LOW ENERGY CHARGED PARTICLES IN DOSIMETRY GLASSES
Klaus Becker 21 Oct. 1966 23 p refs
(USNRDL-TR-1088; AD-642794) CFSTI: HC $3.00/MF $0.65

A new method for the direct determination of particle ranges and depth dose distributions in silver-activated phosphate glasses is based on the successive removal of extremely thin surface layers from the exposed glass by chemical etching (peeling) and measurement of the residual radiophotoluminescence between successive etchings. Glass composition, etching chemicals and etching speed can be varied within wide limits. The experimental technique, using Yokota-type dosimeter glasses and 28% NaOH at 60C (etching speed 0.12 microns/min.) is briefly described. As examples for the practical application of the method, measurements using several types of radiation sources (aqueous solutions of 3H, 63Ni and 35S, solutions and thin and thick solid sources of 239Pu, 237Np and 235U, monoenergetic protons, deuterons and He(+) ions in a wide energy range) were made. Accuracy, possibilities and limitations of the method are briefly discussed. Possible sources of error are: discoloration of the glass because of very high surface doses; incertainties in the determination of the etching speed; etching speed along charged particle tracks higher than the bulk etch rate for ions of very high LET. Author (TAB)

N67-20663# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
NUCLEAR DETECTORS AND THEIR USES
Chu-hsien Wang 19 Sep. 1966 271 p refs Transl. into ENGLISH of the book "Ho Wu Li T'an Ts'e Ch'i i Chi Ch'i ying yung" 1964 567 p
(FTD-TT-65-552; TT-67-60201; AD-643601) CFSTI: HC $3.00/MF $0.65

The present volume provides a comprehensive and systematic introduction to detection technique in nuclear physics. It is divided into four parts: the fundamentals of nucleonic experiment; the various types of detectors (the major part of the book); synchronous application of detectors; and the reduction of experimental data. The book is based on the manuscripts of a series of lectures on

'experimental methods in nuclear physics' given by the author at Chinese University of Science and Technology, supplemented by some new material. TAB

N67-20685# Air Force Systems Command, Kirtland AFB, N. Mex. Air Force Weapons Lab.
CALCULATIONS OF ENERGY LOSS, RANGE, PATHLENGTH, STRAGGLING, MULTIPLE SCATTERING, AND THE PROBABILITY OF INELASTIC NUCLEAR COLLISIONS FOR 0.1- TO 1000-MeV PROTONS Technical Report, 1 Sep. 1964–1 May 1966
Joseph F. Janni Sep. 1966 447 p refs
(AFWL-TR-65-150; AD-643837) CFSTI: HC$3.00/MF$0.65

Theoretical calculations have been made of the mean energy loss, pathlength, range, multiple scattering, and pathlength straggling of protons in 74 materials, including materials regularly used in radiation shielding and dosimetry. Emphasis has been placed on obtaining accurate results, especially for heavy materials and protons of very low energy. Values of the energy loss between 0.1 and 1.0 Mev were obtained by smoothing and interpolating experimental information. Above 1.0 Mev, the Bethe equation with all the necessary shell corrections has been used. The polarization effect has been calculated in detail for each material. Ranges have been obtained from the pathlengths by use of detailed multiple coulomb scattering theory. Comprehensive tabulations of the range straggling and multiple scattering have been presented for each of the materials. The energy loss and range calculations have been compared with the available experimental data and the mean deviation is usually within 1.0 percent. Deviation rarely exceeds the estimated error of the experimental data. The theoretical approach is also discussed in detail, and the method used to obtain the K, L, M, N, and O shell corrections is presented. A first-order correction has been made which compensates for the molecular binding effects occurring in compounds. The probability that a proton will undergo an inelastic nuclear interaction throughout its entire pathlength is also tabulated. TAB

N67-20678# General Dynamics/Convair, San Diego, Calif. Gas Surface Physics Group.
GAS-SURFACE INTERACTIONS, ANNUAL REPORT, 15 OCT. 1965–14 OCT. 1966
D. Mc Keown, C. E. Carlston, H. R. Poppa, and M. G. Fox Oct. 1966 54 p refs
(Contract Nonr-3157(00))
(GD/C-DBE-66-016; AD-642094) CFSTI: HC$3.00/MF$0.65

Contents: Determination of ion ranges in solids by sputtering, by D. McKeown, H. R. Poppa, and M. G. Fox; A method for conducting gas-surface experiments on satellites, by D. McKeown, C. E. Carlston, and M. G. Fox. TAB

N67-20679# Oak Ridge National Lab., Tenn. Nuclear Div.
MONTE CARLO CALCULATIONS, USING THE ALBEDO CONCEPT, OF THE FAST-NEUTRON DOSE RATES ALONG THE CENTER LINES OF ONE- AND TWO-LEGGED SQUARE CONCRETE OPEN DUCTS AND COMPARISON WITH EXPERIMENT
R. E. Maerker and F. J. Muckenthaler 21 Sep. 1966 29 p refs Submitted for publication
(ORNL-TM-1557; AD-642522) CFSTI: HC$3.00/MF$0.65

Monte Carlo calculations have been carried out to determine the fast-neutron dose-rate distributions along the center lines of both a straight and a two-legged square concrete duct for a particularly demanding source geometry. The calculations incorporated doubly differential dose albedo data for concrete which were previously reported. A comparison of the results of the calculations with those from a geometrically similar experiment shows good agreement and places on a firm foundation the concept of treating the fast-neutron duct transmission problem as a reflection phenomenon at a point which is describable by the differential albedo properties of the walls. Author (TAB)

N67-20729# Brookhaven National Lab., Upton, N. Y.
LINAC CAVITY FIELD CALCULATIONS
P. F. Dahl, K. Jellett, G. Parzen, S. Giordano, D. Young et al (Midwestern Univ. Res. Assoc. Stoughton, Wis.) [1966] 7 p Presented at the Linear Accelerator Conf., Los Alamos, N. Mex. Prepared jointly with Midwestern Univ. Res. Assoc., Stoughton, Wis.
(Contract AT(30-2)-GEN-16)
(BNL-10671; Conf.-661021-4) CFSTI: HC$3.00/MF$0.65

The accuracy of mesh-relaxation computer programs for determining the resonant frequency and the electromagnetic fields of linac cavities is studied. An estimate of these accuracy is made by comparing the results of the computer programs JESSY and MESSYMESH with experimentally measured results. The percent difference between the measured and computed results are plotted. This difference varied from 0.13 to 0.95%. Qualitatively comparison with measured results indicated an error in the computer results for the frequency of about 0.5%. NSA

N67-20730# California Univ., Berkeley. Lawrence Radiation Lab.
LEVELS OF ^{188}Os POPULATED BY ^{188}Re AND ^{188}Ir
T. Yamazaki, J. Sato (Tokyo Univ.), Y. Ookoyama, S. Baba (Japan Atomic Energy Res. Inst., Ibaraki), H. Ikegami (Tokyo Inst. of Tech.) et al Jul. 1966 12 p Presented at the Intern. Conf. on Nucl. Phys., Gatlinburg, Tenn. Submitted for publication
(Contract W-7405-ENG-48)
(UCRL-16996; CONF-660906-27) CFSTI: HC$3.00/MF$0.65

On the basis of an experimental study of the Re^{188} and Ir^{188} decays to Os^{188}, some remarkable features, such as the nature of the lowest K=2 band, the 0+ states, and the beta decay modes to quasiparticle states, are discussed. Author (NSA)

N67-20731# Stanford Univ., Calif. Linear Accelerator Center.
KLYSTRONS FOR THE STANFORD LINEAR ACCELERATOR CENTER
J. V. Lebacqz, G. K. Merdinian, and R. W. Bierce Aug. 1966 8 p refs Presented at the 6th Intern. Conf. on Microwave Optical Generation and Amplification, Cambridge, Mass., 12–16 Sep. 1966
(Contract AT(04-3)-400)
(SLAC-PUB-208; CONF-660932-1) CFSTI: HC$3.00/MF$0.65

A brief review is presented on the design and performance of the pulsed S-band klystrons for the Stanford Linear Accelerator. Included are the mean values of measured power output and an analysis of the information available to date on tube life. NSA

N67-20732# Atomics International, Canoga Park, Calif.
EFFECT OF IMPURITIES ON THE RECOVERY STAGES OF ELECTRICAL RESISTIVITY IN NICKEL BOMBARDED BY ELECTRONS AT LOW TEMPERATURES
J. L. Oddou, C. Minier-Cassayre, and P. Moser [1966] 6 p Transl. into ENGLISH from Comm. a l'Energie Atomique, Grenoble, France, Rept. BP-269
(AI-Trans-220)

The isochronal recovery curves of the resistivity increase $\Delta\rho$ were plotted for electron-bombarded samples of pure Ni and Ni containing impurities. The comparison of these curves exhibits the interaction between point defects created by irradiation and impurities. Author (NSA)

N67-20742# Brookhaven National Lab., Upton, N. Y.
MEASUREMENTS AND CALCULATIONS ON THE 50-MeV BROOKHAVEN LINAC
K. Batchelor, R. Chasman, and T. Werntz [1966] 18 p refs
(Contract AT(30-2)-GEN-16)
(BNL-10670; CONF-661021-1) CFSTI: HC $3.00/MF $0.65

Data are presented representing a series of measurements and calculations carried out on the 50-MeV Brookhaven linac. Many of the results obtained are applicable to the proposed AGS conversion program since the present cavity length is more than one and one half times greater than any cavity in the new proposal. Measurements of the transient and steady-state phase and amplitude changes between center and end of the center-fed cavity are presented with calculated values obtained from the theory of Nishikawa. Also beam energy measurements are presented together with some previous computational data. Good agreement is found between measurements and the computational data for phase and amplitude effects in the linac. NSA

N67-20743# Aktiebolaget Atomenergi, Stockholm (Sweden).
MICROANALYSIS OF FLUORINE CONTAMINATION AND ITS DEPTH DISTRIBUTION IN ZIRCALOY BY THE USE OF A CHARGED PARTICLE NUCLEAR REACTION
E. Moeller and N. Starfelt Jul. 1966 16 p refs
(AE-237)

Fluorine contamination on and below the surface of Zircaloy was studied by means of proton irradiation using a Van de Graaff accelerator and the detection of prompt gamma radiation from the $F^{19}(p,\alpha\gamma)O^{18}$ reaction. Formulas for deriving depth distributions of impurities from the measured counting rates were derived. The influence of energy straggling on the depth resolution was studied. Both the total amount and the depth distribution were measured in samples, which had undergone different treatments. Because of the high yield from the reaction used, a quantity of fluorine less than 0.01 $\mu g/cm^2$ can be detected by this method. Author (NSA)

N67-20752# Brookhaven National Lab., Upton, N. Y. Information Div.
ON THE FEASIBILITY OF USING GALLIUM AS A SOLAR NEUTRINO DETECTOR
A. A. Pomanskii Jun. 1966 21 p refs Transl. into ENGLISH from Russian
(BNL-TR-88) CFSTI: HC $3.00/MF $0.65

The study of the feasibility of gallium as a solar neutrino detector includes the problem of extracting germanium from gallium after the reaction $\nu + {}^{71}Ga \rightarrow {}^{71}Ge + e^-$ and the various background processes of ^{71}Ge formation. From the analysis it is evident that the use of gallium as a detector of solar neutrinos presents no serious difficulties. The most difficult problems are the development of a low background counter for the registration of the decay of radioactive germanium-71 and a total purification of germanium extracted from arsenic. NSA

N67-20754# Brookhaven National Lab., Upton, N. Y.
NUCLEAR STRUCTURE PHYSICS WITH 1-BeV PROTONS
H. Palevski 13 Oct. 1966 30 p refs Presented at the Intern. Conf. on Nucl. Phys., Gatlinburg, Tenn., 12–17 Sep. 1966
(Contract AT(30-2)-GEN-16)
(BNL-10686; CONF-660906-38) CFSTI: HC $3.00/MF $0.65

The theoretical bases and the experimental arrangement for the use of 1-GeV protons in studies of nuclear structure are discussed, together with some observations of proton scattering by ^{12}C, He, H, and ^{16}O and of the $^{12}C(p,d)^{11}C$ reaction. Some evidence for the existence of quasi-free n-p pairs in the C nucleus is presentad. NSA

N67-20756# California Univ., Berkeley. Dept. of Physics.
NOTES ON DYNAMIC PROTON POLARIZATION
C. D. Jeffries 23 Sep. 1966 46 p refs
(Contract AT(11-1)-34)
(UCB-34P20-T-1) CFSTI: HC $3.00/MF $0.65

Rate equations are developed for the polarizations of an electron-nuclear spin system consisting of Nd^{3+} spins $\underline{S}$ surrounded by proton spins $\underline{I}$ within the diffusion barrier and many distant proton spins $\underline{I}'$, appropriate to 1% Nd in $La_2Mg_3(NO_3)_{12}\cdot 24H_2O$. A shell-of-influence model, modified to include diffusion and undesirable magnetic impurities, is used to predict a unique proton relaxation rate, which is found to be in agreement with measurements, in magnitude and in dependence on field and temperature. The coupled rate equations for dynamic proton polarization by saturation of forbidden I_+S_- microwaves transitions are discussed. When the relative abundance of protons to Nd^{3+} ions is correctly taken into account, the microwave power required to saturate the proton polarization is found to agree with the observations. Rate equations are developed and solved for the case of dynamic polarizations in the presence of a phonon bottleneck. In the typical case of 1% Nd: LaMN at 4mm the bottleneck has only a small effect on the proton polarization and saturation behavior. Author (NSA)

N67-20759# California Univ., Berkeley. Lawrence Radiation Lab.
NEW DATA ON THE DECAY OF Lu^{177m}
A. J. Haverfield and F. M. Bernthal Jul. 1966 9 p refs Presented at the Intern. Conf. on Nucl. Phys., Gatlinburg, Tenn., 12–15 Sep. 1966
(Contract W-7405-ENG-48)
(UCRL-16995; CONF-660906-26) CFSTI: HC $3.00/MF $0.65

A lithium-drifted germanium detector having a resolution of 1.3 keV at 122 keV was used to examine the gamma-ray spectrum of Lu^{177m}. Three new transitions have been found which fit into the previous decay scheme. Gamma-ray relative intensity measurements have been used to derive many of the parameters associated with the unified nuclear model. Of particular interest is the comparison of derived E1 transitions probabilities to simple theory. Author (NSA)

N67-20761# International Centre for Theoretical Physics, Trieste (Italy).
COUPLING PROBLEM FOR U(p,q) "LADDER" REPRESENTATIONS, I
R. L. Anderson, J. Fischer, and R. Raczka Aug. 1966 21 p refs Submitted for publication
(IC-66/102)

The results of an initial investigation of the couplings of three most degenerate representations of U(p,q) are presented. Function bases are obtained for the ladder representations by realizing the Bose operators and thus the algebra L(p,q) with differential forms. Also it is shown that these representations can be integrated to irreducible global representations of the universal covering group. As an example the Clebsch–Gordan coefficient for the coupling of two U(1,1) ladder representations are presented. The result is obtained that there is only one ladder representation in the direct product of two ladder representations. NSA

N67-20764# Deutsches Elektronen-Synchrotron, Hamburg (West Germany).
LOW MOMENTUM TRANSFER NEUTRON FROM FACTORS FROM ANALYSIS OF DEUTERON ELECTRODISINTEGRATION
D. Braess, D. Hasselmann, and G. Kramer (Hamburg Univ.) Sep. 1966 21 p refs
(DESY-66/21)

Electromagnetic form factors of the neutron are calculated from recent inelastic e-d scattering measurements which were performed at the quasi-elastic peak and at momentum transfers below 5 f^{-2}. The theory used in the analysis includes a realistic description of the deuteron structure and of the effect of interactions between the outgoing nucleons. It is found that the rescattering corrections are very important in this region of momentum transfer. Concerning the charge form factor G_{2E} of the neutron, it is concluded that meaningful results cannot be given at the moment. The magnetic form factor of the neutron G_{2M}/μ_2 comes out still larger than, but closer to, the magnetic form factor G_{1M}/μ_1 of the proton compared to former analyses. More measurements around $q^2 = 1f^{-2}$ seem to be very interesting in this respect.
Author (NSA)

N67-20766# California Univ., Berkeley. Lawrence Radiation Lab.
TWO-HUNDRED BeV ACCELERATOR: STUDIES ON EXPERIMENTAL USE, 1964–1965. VOLUME I: PARTICLE PRODUCTION, EXPERIMENTS AND BEAMS
Geoffrey F. Chew et al Apr. 1966 378 p refs
(Contract W-7405-ENG-48)
(UCRL-16830, Vol. I; UCID-10184, Vol. I) CFSTI: HC $3.00/MF $0.65

A collection of reports (UCID Series) is presented which is connected with the experimental use of the proposed 200 GeV accelerator. The reports are grouped in two broad categories: high-energy elementary particle reactions and experiments and secondary beams.
B.G.D.

N67-20768# Princeton-Pennsylvania Accelerator, Princeton, N. J.
CHARGE EXCHANGE SCATTERING OF K^+ MESONS ON Be^9 AT .970 GeV/c
Joseph Gezelter 22 Aug. 1966 137 p refs
(Contract AT(30-1)-2137)
(PPAD-598F) CFSTI: HC $3.00/MF $0.65

The angular distribution of K^0 mesons from the reaction $K^+ + n \rightarrow K^0 + p$ was measured using a .970 GeV/c K^+ beam incident on the thin plate spark chamber which contained beryllium targets. The cms angular distribution was obtained after corrections were made for N^* production and the geometry of the spark chamber. The method of least squares was used, and six sets of real, I=0, S and P wave phase shifts were found which were the locations of local minima. I=1, complex, S and P wave phase shifts and the $K^+ - n$ total cross section given by Cook in UCRL-10130 were used in the phase shift analysis. The six sets of solutions can be broken up into 3 groups of 2 sets each with the sets in each group approximately related by the Fermi–Yang ambiguity. One of these groups is very similar to the two Fermi–Yang solutions which workers at lower energies have favored. Only one of these two sets predicts a value for the $K^+ - n$ total charge exchange cross section which is close to the apparent plateau value found at lower energies. None of the other sets predicts a reasonable value for the $K^+ - n$ charge exchange cross section.
Author (NSA)

N67-20771# Stanford Univ., Calif. Linear Accelerator Center.
BEAM BREAK-UP EXPERIMENTS AT SLAC
O. H. Altenmueller, E. V. Farinholt, Z. D. Farkas, W. B. Herrmannsfeldt, H. A. Hogg et al Oct. 1966 38 p refs Presented at the 1966 Linear Accelerator Conf., Los Alamos, N. Mex., Oct. 1966
(Contract AT(04-3)-515)
(SLAC-PUB-224; CONF-661021-14) CFSTI: HC $3.00/MF $0.65

A description of the beam break-up effect, both qualitatively and quantitatively, is presented as it has been observed and understood so far. Results derived from microwave cold tests, microwave beam tests, focusing beam tests, and a few other miscellaneous experiments involving the beam are discussed. From all these experiments, it is shown how the presently adopted corrective program evolved. A short description of the remedies is given, together with the improvements expected.
NSA

N67-20772# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics.
BARYON DECAYS WITH DALITZ PAIR FORMATION [RASPADY BARIONOV S OBRAZOVANIEM PARY DALITSA]
B. N. Veluev 1966 11 p refs In RUSSIAN
(JINR-P-2823)

The process $B_1 \rightarrow B_2 + e^- + e^+$ is considered, where B_1 and B_2 are 1/2 spin·baryons (or antibaryons). In the polar (singlephoton) approximation the measured values are expressed by four form factors, necessary to describe this process. The obtained expressions turn out to be helpful for the detailed checking CP invariance. General formulas, in which the electron mass is not neglected, are applied also to the decays with μ meson pair production.
Author (NSA)

N67-20773# Commissariat a l'Energie Atomique, Fontenay-aux-Roses (France). Centre d'Etudes Nucleaires.
ANALYSIS OF RADIONUCLIDE MIXTURES BY α–γ AND β–γ COINCIDENCES USING A SIMPLE DEVICE [ANALYSE DE MELANGES DE RADIONUCLEIDES PAR UN DISPOSITIF SIMPLE DE COINCIDENCES α–γ ET β–γ]
Raymond Pottier and Rene Berger Jun. 1966 44 p refs In FRENCH
(CEA-R-3033)

A procedure is described for the qualitative and quantitative spectrographic analysis of radioactive sources containing two alpha–gamma emitters having the same alpha energy or two beta–gamma emitters having the same gamma energy. The main apparatus is a multichannel pulse-height analyzer including a coincidence circuit. The principle of the method, the synoptic scheme, the electronic device, the type of sources, and the precautions to be taken or the corrections to take into account are reported. The results obtained in solving the three following problems are discussed as examples of applications of the method: analysis for ^{241}Am in alpha–gamma sources containing ^{238}Pu; analysis for ^{237}Np in beta–gamma sources containing ^{239}Pu; and analysis for ^{106}Ru–^{106}Rh in beta–gamma sources containing ^{95}Zr–^{95}Nb.
Author (NSA)

N67-20778# Parametrics, Inc., Waltham, Mass.
GENERATION AND PRACTICAL USE OF MONOENERGETIC X-RAYS FROM ALPHA EMITTING ISOTOPES Annual Report, Dec. 1964–Dec. 1965
Bach Sellers Jan. 1966 63 p refs
(Contract AT(30-1)-3491)
(NYO-3491-1) CFSTI: HC $3.00/MF $0.65

Many analytical applications of X-ray techniques, for instance composition analysis, require that the X-ray spectrum possess a high degree of monochromaticity. The possibilities of satisfying this requirement through generation of characteristic X-radiation as a result of the interaction of various radiations with materials are summarized. The advantages of using radioactive alpha particles as the exciting radiation, including the lack of any significant bremsstrahlung or scattered source radiation, are pointed out. Experimental results on the characteristic X-ray yield as a result of radioactive alpha bombardment are presented, and these yields are shown to be in theoretical agreement with those observed by other investigators using proton excitation.
Author (NSA)

N67-20781# California Inst. of Tech., Pasadena.
CURRENT TOPICS IN PARTICLE PHYSICS
Murray Gell-Mann [1966] 31 p Presented at the 13th Intern. Conf. on High Energy Phys., Berkeley, Calif., 31 Aug. 1966
(Contract AT(11-1)-68)
(CALT-68-101; CONF-660808-21) CFSTI: HC $3.00/MF $0.65

A brief summary is presented on the current topics of elementary particle physics. Included are Regge pole and optical model analysis of high energy scattering, bound and resonant states of mesons and baryons, the quark model, current algebra, and CP violation. NSA

N67-20782# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy.
DETECTION OF THE $\pi^0 + \gamma$-DECAY OF ω^0-MESONS PRODUCED BY π^--MESONS WITH THE 9 GeV/C MOMENTUM IN π^--Xe INTERACTIONS [OBNARUZHENIE RASPADA $\pi^0 + \gamma\omega^0$-MEZONOV, ROYHDENNYKH π^--MEZONAMI S IMPUL'SOM 9 GeV/C V π^--Xe VYAIMODEISTVIYACH]
T. I. Kanarek, E. Loskevich, A. S. Martynov, B. Nichiporuk, G. L. Semashko et al 1966 17 p refs In RUSSIAN Submitted for publication
(JINR-P1-2948)

With the help of a 24-liter xenon bubble chamber exposed in the π^- meson beam with the 9 GeV/c momentum the search was performed for radiative decay of neutral bosons, decaying finally into 3 γ-quanta. The $\omega^0 \to \pi^0 + \gamma$ decay was detected directly by the presence of the peak determined from statistics in the effective mass distribution $m_{\pi^0\gamma}$. The upper limit of the ratio of probabilities of two possible channels of ω^0-decay is: $R = W(\omega^0 \to \gamma + \gamma + \gamma)/W(\omega^0 \to \pi^0 + \gamma) \leq 0.2 \pm 0.15$. The lower limit for the total cross section of ω^0 production in π^-–Xe interaction is estimated to be $\sigma_{\chi e}(\omega^0) > 7.1 \pm 1.5$ mb. Author (NSA)

N67-20784# California Inst. of Tech., Pasadena.
CURRENT ALGEBRA
Murray Gell-Mann [1966] 33 p refs Lectures presented at the Intern. School of Phys. "Ettore Majorana", Erice, Sicily, Jul. 1966
(Contract AT(11-1)-68)
(CALT-68-102) CFSTI: HC $3.00/MF $0.65

A review of some of the main ideas of the algebra of currents is presented. These are: isotopic spin operators, the SU(3) group, axial currents, chiral SU(3) $\otimes$ SU(3), commutation relations, and quarks. Other topics discussed are the Lorentz frame when the momenta are zero near infinity, extension of chiral SU(3) $\otimes$ SU(3) algebra and representation of U(3) $\otimes$ U(3) algebra. NSA

N67-20787# Princeton Univ., N. J. Palmer Physical Lab.
EFFECTIVE FORCES IN NUCLEI
G. E. Brown Sep. 1966 16 p refs Presented at the Intern. Conf. on Nucl. Phys., Gatlinburg, Tenn., 12–17 Sep. 1966
(Contract AT(30-1)-937; Grant NSF GP-579)
(PUC-937-229; CONF-660906-35)

A review is presented on the calculation of effective forces in nuclei from the nucleon–nucleon force. Good results were obtained by calculating the effective matrix elements starting from the Brueckner–Bethe reaction-matrix techniques. It is suggested that the techniques be extended to incorporate realistic forces in the Hartree–Fock calculations and in nuclear reaction studies. NSA

N67-20788# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics.
ELEMENTARY PARTICLES OF THE LARGEST MASSES (QUARKS, MAXIMONS)
M. A. Markov 1966 9 p refs
(JINR-E2-2973)

An idea of existence of elementary particles of the largest masses (maximons): $m_1 = e\sqrt{\kappa} \approx 10^{-6}$g, $m_0 = \sqrt{hc/\kappa} \approx 10^{-5}$g based on the general theory of relativity, is presented, and all possible quark properties of these particles are considered. The possibilities of cosmological treating of the elementary particle problem are considered. Author (NSA)

N67-20789# Edgerton, Germeshausen and Grier, Inc., Las Vegas, Nev.
FLUORESCENCE EMISSION DETECTOR WITH 100 PICOSECOND TIME RESOLUTION
R. L. McGuire and R. C. Palmer 21 Oct. 1966 15 p refs Presented at the 13th Ann. Nucl. Sci. Symp., Boston
(Contract AT(29-1)-1183)
(EGG-1183-2122; CONF-661020-4) CFSTI: HC $3.00/MF $0.65

An emission telescope was developed for studying light intensity vs time of scintillators and Cerenkov radiators in the subnano-second time domain. Sample excitation is achieved with 10-MeV, 50-picosecond pulses of electrons from the EG&G/AEC linear accelerator. Test samples are viewed by an ultrahigh speed, coaxially mounted vacuum photodiode detector via a 6-inch spherical mirror with an effective aperture of f/1. Photodiode detector output signals are recorded by a sampling scope, computer-of-average-transients data handling system. Overall time resolution of the system is 150 picoseconds (FWHM). The resolution function is obtained from Cerenkov emission in lucite and water. The response of a few typical fast plastic fluor materials are presented, showing the prompt Cerenkov emission followed by the comparably slow fluorescence rise and decay. Author (NSA)

N67-20795# California Inst. of Tech., Pasadena.
RELATIVISTIC QUARK MODEL AS REPRESENTATION OF CURRENT ALGEBRA
Murray Gell-Mann Oct. 1966 39 p Revised
(Contract AT(11-1)-68)
(CALT-68-103) CFSTI: HC $3.00/MF $0.65

The relativistic quark model as a representation of current algebra is discussed. Topics included are current algebra at infinite momentum, relativistic representation of current algebra, relation to approximate symmetry, covariant formalism, and an example in which mesons made of a free Dirac quark and a free Dirac antiquark are solved in both covariant and noncovariant formalisms. NSA

N67-20797# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems.
SPECIFICATION OF THE N-N PHASE SHIFT ANALYSIS AT 23.1 MEV
Yu. M. Kazarinov, F. Leger, and Z. Yanout 1966 7 p refs Submitted for publication
(JINR-E1-2952)

The N-N phase shift analysis at 23.1 MeV was specified on the basis of new experimental data on the measurement of C_{nn}^{SP} parameter and P_{np} polarization at the angle 140° (cms). It is shown that the addition of new data within the errors does not change the solution found previously. Author (NSA)

N67-20798# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems.
SPECIFICATION OF THE N–N PHASE SHIFT ANALYSIS AT 147 MeV
Yu. M. Kazarinov, F. Leger, and Z. Yanout 1966 31 p refs Submitted for publication
(JINR-E1-2953)

Specification of the N–N phase shift analysis at 147 MeV was performed by using all data available at the energies near to 147 MeV. The data on effective cross section of np- and pp-scattering and pp-scattering polarization were normalized to this energy. The angular dependences of the experimental quantities were calculated and are presented. Author (NSA)

N67-20799# California Univ., Davis. Crocker Nuclear Lab.
SOLUBLE THREE-BODY MODEL OF STRIPPING
L. R. Dodd 23 Aug. 1966 7 p refs Presented at the Intern. Conf. on Nucl. Phys., Gatlinburg, Tenn.
(Contract AT(11-1)-GEN-10)
(UCD-CNL-68; CONF-660906-39) CFSTI: HC $3.00/MF $0.65

A soluble, three-body model of deuteron stripping, which is based on a new reduction of the Feddeev equations, is described. An important advantage of the model is that the separable potential approximation is used only for the proton–neutron system; the proton-core, neutron-core interactions may be central. The three-body dynamics are treated exactly. Author (NSA)

N67-20801# California Univ., Berkeley. Lawrence Radiation Lab.
ANOMALIES IN NUCLEAR MASSES
William D. Myers and Wladyslaw J. Swiatecki 10 Aug. 1966 24 p refs Presented at the Intern. Symp. on Why and How Should We Investigate Nuclides Far Off the Stability Line, Lysekil, Sweden, 21–27 Aug. 1966
(Contract W-7405-ENG-48)
(UCRL-17070; CONF-660817-7) CFSTI: HC $3.00/MF $0.65

Recently gained insight into the nature of the shell correction to the mass of a nucleus, regarded as a function of nuclear deformation, enables one to understand some of the outstanding anomalous trends in nuclear masses, including the behavior of fission barriers. Author (NSA)

N67-20802# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics.
ANALYTICITY, LOCALITY, AND SYMMETRY WITH INFINITE MULTIPLETS
Dao Vong Duc and Nguyen Van Hieu 1966 17 p refs Submitted for publication
(JINR-E2-2932)

The analytical properties of scattering amplitudes are studied in the framework of symmetry theory with infinite multiplets. For simplicity the group SL(2,c) is chosen as internal symmetry group. The relation between symmetry theory with infinite multiplets and quantum field theory is also considered. It is shown that the requirement of symmetry is incompatible with the usual local property of interacting fields. Author (NSA)

N67-20803# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Neutron Physics.
AN APPROXIMATE METHOD OF SOLVING THE THREE-NUCLEON PROBLEM WITH CENTRAL INTERACTION [PRIBLIZHENNYI METOD RESHENIYA ZADACHI TREKH NUKLONOV S TSENTRAL'NYM VZAIMODEISTVIEM]
V. N. Efimov 1966 22 p refs In RUSSIAN
(JINR-P-2890)

The Bubnov–Galerkin's method is applied to solve the three-nucleon problem. According to this method the wave functions are expanded (in the region where the potential acts) in a complete set of basic functions, which depend on the distance between two nucleons and which are orthogonal to the weight, determined by the radial dependence of the potential. The method allows one to reduce the solution for the three-nucleon problem to the solution for the system of integral equations. The elastic n–d scattering amplitude is expanded in a power series in the small parameter. Author (NSA)

N67-20804# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems.
BRANCHING RATIO IN K^0_{S3}-DECAY [ZARYADOVOE OTNOSHENIE V K^0_{S3}-RASPADE]
A. N. Mestvirishvili, D. Nyagu, N. I. Petrov, V. A. Rusakov, and Tzun-fan Wu 1966 5 p refs In RUSSIAN
(JINR-P-2892)

On the basis of the identification of 866 K^0_{S3} and 28 $K^0_{\mu 3}$ decays the branching ratio is found to be $R = N(K^0_2 \to \pi^+ + e^-(\mu^-) + 0)/N(K^0_2 \to \pi^- + e^+(\mu^+) + 0) = 1.04 \pm 0.07$. Author (NSA)

N67-20806# Princeton Univ., N. J. Palmer Physical Lab.
BOUND ISOBARIC ANALOG STATES IN MEDIUM-WEIGHT NUCLEI
E. Rost Jul. 1966 6 p refs Presented at the Intern. Conf. on Nucl. Phys., Gatlinburg, Tenn., 1966
(Contract AT(30-1)-937)
(PUC-937-222; CONF-660906-36) CFSTI: HC $3.00/MF $0.65

The 28-MeV (p,d) data of Sherr [Phys. Rev. 139: B1272(1965)] in which $7/2^-$ analog states were observed in medium-weight nuclei were re-examined in the light of recent improvements in the distorted-wave analysis. These improvements bring the extracted spectroscopic strengths in agreement with theory. The use of a constant-well-depth model indicates a larger proton than neutron radius for the observed $f_{7/2}$ orbitals. Author (NSA)

N67-20807# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy.
ON THE QUASIELASTIC SCATTERING OF HIGH-ENERGY PARTICLES BY LIGHT NUCLEI [O KVAZIUPRUGOM RASSEYANII CHASTITS VYSOKIKH ENERGII NA LEGKIKH YADRAKH]
B. P. Bannik, V. L. Lyuboshits, and M. I. Podgoretskii 1966 20 p refs In RUSSIAN
(JINR-P-2881)

The isotopic and ordinary spin-selection rules for quasielastic scattering in high-energy particle collisions with light nuclei are discussed and systematized in the framework of the impulse approximation. The angular dependence of the cross sections for the nuclear level excitation and charge exchange in the region of small momentum transfers is analyzed. The relations are given between the quasielastic scattering cross section and the γ- or β-decay rate. The study of quasielastic scattering on light nuclei can provide valuable information about the spin–spin interaction contribution to the elastic n–n scattering amplitude. Author (NSA)

N67-20810# California Univ., Berkeley. Lawrence Radiation Lab.
MEASUREMENTS OF THE LINEAR-ACCELERATOR EXIT BEAM OF THE BEVATRON INJECTOR
Robert W. Allison, Jr., Don M. Evans, Robert M. Richter, Allen J. Sherwood, and Emery Zajec 19 Sep. 1966 44 p refs Presented at the Linear Accelerator Conf., Los Alamos, N. Mex., 3–7 Oct. 1966
(Contract W-7405-ENG-48)
(UCRL-17001; CONF-661021-20) CFSTI: HC $3.00/MF $0.65

A series of measurements of the characteristics of the linear accelerator (linac) exit beam were made to determine if variations

in beam position, emittance, and energy spread were present. These measurements show that beam position movements due to voltage ripple on the preinjector and linac rf systems occur. Positions were measured with a resonant 200-MHz induction electrode which detects the center of gravity of the beam. In addition, a series of momentum measurements were made to study filamentation of the linac beam, and the effect of the prebuncher and debuncher. A correlation was obtained between energy ripple and the beam position jitter. An emittance device that uses a sweeping magnetic field for measuring emittance was constructed, and a preliminary study was made of the linac emittance variation with intensity and tank gradient. Author (NSA)

N67-20812# Joint Inst. for Nuclear Research, Dubna (USSR).
PHASE-SHIFT ANALYSIS AND PLANNING OF EXPERIMENTS AT 18.2 AND 9.7 MeV
Yu. M. Kazarinov, F. Legar, I. Ulegla, and Z. Yanout 1966 24 p refs
(JINR-E1-2969)

The simultaneous phase-shift analysis of np and pp data is performed at 18.2 and 9.7 MeV. Three and four sets of phase-shifts are obtained, respectively. Previously obtained nuclear potentials for nonmixing states of two-nucleon system are used to calculate the maximum error in the simultaneous phase-shift analysis, due to the assumption on the additivity of the Coulomb and nuclear phase-shifts. Optimal experiments are planned for a further specification of the phase-shift analysis. The angular distributions of the experimental quantities are given on graphs. Author (NSA)

N67-20815# Technische Hochschule, Karlsruhe (West Germany). Institut fuer Struktur der Materie.
EXACT SOLUTIONS OF THE MILNE-PROBLEM FOR TWO HALF-SPACES WITH DIFFERENT MEDIA AND OF THE PROBLEM OF AN INFINITE PLATE BO THE METHOD OF SPHERICAL HARMONICS [EXAKTE LOESUNGEN DES MILNE-PROBLEMS FUER ZWEI HALBRAEUME MIT VERSCHIEDENEN MEDIEN UND DES PROBLEMG EINER UNENDLICH AUSGEDEHNTEN PLATTE NACH DER KUGELFUNKTIONSMETHODE]
A. Korn Bad Godesberg, West Germany, Bundesmin. fuer Wiss. Forschung, Jul. 1966 28 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Wiss. Forschung
(BMWF-FBK-66-19)

W. Kofink published a solution in P_{L+1} approximation for the stationary monoenergetic Boltzmann equation in plane geometry and for linear anisotropic scattering using the spherical harmonics method. Taking this solution, two problems in plane geometry were solved: the problem of two adjacent half-spaces and the problem of an infinitely extended slab surrounded by homogeneous matter. In the limit $L+1 \to \infty$ exact solutions of these two problems were obtained which are very suitable for numerical calculations. Author (NSA)

N67-20817# Pennsylvania Univ., Philadelphia. Dept. of Physics.
THEORETICAL AND EXPERIMENTAL RESEARCH ACTIVITIES IN HIGH ENERGY PHYSICS Progress Report, Sep. 1965–Sep. 1966
S. A. Bludman et al 1 Oct. 1966 54 p refs
(Contract AT(30-1)-2171)
(NYO-2171-210) CFSTI: HC $3.00/MF $0.65

The theoretical and experimental research activity of the Univ. of Pennsylvania in elementary particle physics from Sept. 1965 thru Sept. 1966 is reported. Topics discussed are nuclear structure, pion-nucleon scattering, symmetry groups, current commutator algebra, experiments with the Princeton–Pennsylvania Accelerator, bubble chamber analysis program, and experimental support activities. NSA

N67-20821*# Westinghouse Electric Corp., Pittsburgh, Pa. Astronuclear Lab.
NEUTRON INTERFERENCE SCATTERING IN CRYSTALLINE SOLIDS Progress Report
A. S. Johnston Aug. 1966 36 p refs
(Contract SNP-1)
(NASA-CR-83201; WANL-TME-1492) CFSTI: HC $3.00/MF $0.65 CSCL 20H

The literature was studied to determine the principles, the methods, and the current results of calculations of inelastic neutron scattering from polycrystalline beryllium and graphite and to determine the agreement that has been obtained between calculations and measurements of the elastic and inelastic neutron scattering cross section. The principles by which the inelastic scattering cross section is calculated are outlined, some of the Born-Von Karman models proposed for hexagonal lattices are described, and methods of numerically evaluating the inelastic scattering cross section formulas are discussed. Author (NSA)

N67-20822# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics.
NONLOCAL QUANTUM THEORY OF SCALAR FIELD [NELOKAL'NAYA KVANTOVAYA TEORIYA SKALYARNOGO POLYA]
G. V. Efimov 4 Aug. 1966 22 p refs In RUSSIAN Submitted for publication
(JINR-P-2870)

A scheme is suggested for constructing the S-matrix using the perturbation theory free from ultraviolet divergences by the example of the one-component scalar quantized field. The S-matrix is unitary on the mass shell. The causality is violated in small space-time regions. The effects, which are due to this violation at large distances, are described by very high perturbation orders, and therefore are very weak in perturbation theory. Author (NSA)

N67-20824# Princeton–Pennsylvania Accelerator, Princeton, N. J.
NUCLEAR CHEMISTRY RESEARCH AT PRINCETON UNIVERSITY Annual Progress Report, 1965–1966
T. D. Thomas, R. A. Naumann, and S. B. Kaufman 30 Jun. 1966 64 p refs
(Contract AT(30-1)-2137)
(PPAD-593E) CFSTI: HC $3.00/MF $0.65

The decays of Ce^{132}, Ce^{138}, Ce^{137}, La^{132}, and La^{134} were investigated; the energy levels of Ba^{132} were studied through the decay of La^{132}. A method for separating the rare earths by ion-exchange chromatography was developed. A 20-min activity was observed in a mixture of Os and Ru and was tentatively assigned to Os^{180}; the presence of the 2.4-min Re^{180} isomer was determined from the γ spectrum. The energy levels of Pt^{188} and Pt^{189} were investigated through the decay of Au^{188} and Au^{189}, and two negative-parity levels were located in Hg^{194}, Hg^{196}, and Hg^{198} from the electron-capture decay of isomeric Tl^{194}, Tl^{196}, and Tl^{198}. The multipolarities of some transitions in Hg^{194}, Hg^{196}, and Hg^{198} were also established. Angular-momentum effects in the gamma de-excitation of fission fragments were studied theoretically, as was the validity of level-density expressions for high angular momentum. The effects of angular momentum on the evaporation of alpha particles and nucleons were calculated using the statistical mode. The emission of light charged particles in the fission of Cf^{252} was investigated experimentally, as was the production of isomeric Hg^{193}, Hg^{195}, Hg^{197}, Tl^{196}, and Tl^{198} in the spallation of U^{238} by 2.8-BeV protons. A scintillation detection system was developed to reduce the background in an Orange beta spectrometer, and isotope-separated samples of radioisotopes were investigated using retardation collection of ions on thin wire electrodes. NSA

N67-20826 Institutt for Atomenergi, Kjeller (Norway).
MAGNA: A MULTI-SOURCE GAMMA SHIELDING PROGRAMME
Ulf Tveten Jun. 1966 72 p refs
(KR-111)

MAGNA is a gamma computer program written in Fortran 3600 for a CDC 3600 computer. It calculates gamma dose rates in chosen points in or around a set of gamma sources and shields. The sources must be point sources or cylindrical sources, but there are no restrictions to position and orientation. The shields may be cylindrical, cylindrical shell, finite rectangular slab, or infinite slab, and there are very liberal rules to the way the components may be placed. The program was developed as a component shield code and is very useful as such. Shadow-shielding and self-shielding effects are included in the computations. Author (NSA)

N67-20827# California Univ., Livermore. Lawrence Radiation Lab.
MAGNETIC FIELD GENERATED BY A HELICAL GUIDING COIL IN THE ASTRON TANK
N. C. Christofilos 29 Sep. 1966 5 p
(Contract W-7405-ENG-48)
(UCID-15022) CFSTI: HC $3.00/MF $0.65

A helical coil was installed in the Astron tank in the region of the inflector. The purpose of this coil is to create a magnetic field groove to guide the injected electrons so that they miss the inflector after their first turn in the Astron tank. The radius of the coil is smaller than the orbit radius of the injected electrons. The coil is a double helix with the current alternating in adjacent conductors. The field distribution is solved analytically in the idealized case where the coil's radial thickness is zero and the helix is represented by axisymmetric loops, with the current alternating the adjacent loops. A description of the system is included. NSA

N67-20829 Brookhaven National Lab., Upton, N. Y.
MAGNITUDE OF THE K_L^0–K_S^0 MASS DIFFERENCE
J. Canter, Y. Cho (Carnegie Inst. of Tech.), D. Hill, D. K. Robinson, M. Sakitt et al [1966] 6 p Presented at the 13th Intern. Conf. on High Energy Phys., Berkeley, Calif.
(Contract AT(30-2)-GEN-16)
(BNL-10608; CONF-660808-19) CFSTI: HC $3.00/MF $0.65

The magnitude of the mass difference $|\Delta m| = |m_{K_L^0} - m_{K_S^0}|$ was measured by studying the time dependence of strangeness = −1 hyperons produced by neutral K's originating from the reaction: $K^+ + d \rightarrow K^0 + p + p +$ At time t=0, one has a K^0 state. Thus, the intensity of hyperons as a function of time is given by the expression: $N(t) \alpha [e^{-\lambda_S t} + e^{-\lambda_L t} - 2 \cos(\Delta m t) e^{-(\lambda_S + \lambda_L)t/2}]$. The momentum of the neutral K's in our experiment is in the range 100–550 MeV/c. The hyperons were produced in the following reactions: $K^0 + d \rightarrow \Lambda^0 + \pi^+ + n$, $\rightarrow \Sigma^0 + \pi^+ + n$, $\rightarrow \Lambda^0 + \pi^0 + p$, $\rightarrow \Sigma^0 + \pi^0 + p$, $\Lambda^0 + \pi^+ + \pi^- + p$, and $\rightarrow \Sigma^0 + \pi^+ + \pi^- + p$. Charged Σ events were not included in this analysis since these events are more difficult to detect and analyze. Author (NSA)

N67-20835# Princeton Univ., N. J. Palmer Physical Lab.
NUCLEAR SPECTROSCOPY IN THE $1f_{7/2}$ REGION BY THE (p,d) AND (p,t) REACTIONS
Charles A. Whitten, Jr. (Ph.D. Thesis) May 1966 202 p refs
(Contract AT(30-1)-937)
(PUC-937-211) CFSTI: HC $3.00/MF $0.65

The ^{40}Ar(p,d) and (p,t), ^{51}V(p,d) and (p,t), ^{53}Cr(p,d) and (p,t), ^{54}Cr(p,d) and (p,t), and ^{52}Cr(p,p') reactions were studied using 17.5-MeV protons. Thin (≈0.5 mg/cm^2) isotopic foils were used as targets in the vanadium and chromium reaction studies while a gas cell was used in the argon experiment. The deuterons and tritons were identified by a dE/dx–E solid state detector telescope. Total resolution of the system was ≈55 to 70 keV. Absolute cross sections for the vanadium and chromium reactions were obtained using thick natural target foils. Angular distributions for many (p,d) and (p,t) transitions were obtained from θ_{lab} = 15° to 150°. Spectroscopic factors for 1_n = 0, 1_n = 1, 1_n = 2, and 1_n = 3 for (p,d) transitions were obtained by comparing the experimental angular distributions with the predictions of the distorted wave Born approximation (DWBA) theory of the (p,d) reaction. The DWBA program we used approximated both finite range and non-local effects in the reaction mechanism. The 1_n = 3 (j_n = 7/2) spectroscopic factors in the ^{51}V(p,d)^{50}V and ^{52}Cr(p,d)^{51}Cr reactions were compared with the predictions of the McCullen, Bayman, and Zamick theory, which assumes pure $(f_{7/2}^n)$ configurations for the levels in ^{50}V and ^{51}Cr. In the ^{53}Cr(p,d) reaction both the ^{52}Cr ground state and the 1.434 MeV 2$^+$ level were excited by 1_n = 1 transitions, showing admixture in the ^{53}Cr ground state of the configuration $[|^{52}\text{Cr}(1.434\ \text{MeV})|^{2+}\ 2p_{3/2}]^{3/2}$. Four levels in ^{52}Cr with excitation energies between 3.4 and 4.1 MeV were strongly excited in the (p,d) reaction by 1n = 3 transitions, thus presenting strong evidence that their wave functions have large admixtures of the neutron configuration $(f_{7/2}^{-1}p_{3/2})^{J=2,3,4,5}$. In the ^{54}Cr(p,d)^{53}Cr reaction definite J dependence was seen in both the 1n = 1 (J = 1/2 or 3/2) and 1n = 3 (J = 5/2 or 7/2) (p,d) angular distributions. Strong 1n = 3 ^{54}Cr(p,d) transitions were found to 7/2$^-$ levels in ^{53}Cr at 1.284, 1.532, and 3.339 MeV. In both the ^{54}Cr(p,d) and ^{52}Cr(p,d) reactions a single 1n = 0 transition is found which seems to exhaust most of the $T_<$ spectroscopic strength. The ^{52,53,54}Cr (p,t) experiments along with the ^{53}Cr(p,d) work indicates that the 2.648 MeV 0$^+$ level in ^{52}Cr is based upon the neutron configuration $[f_{7/2}^{-2}]^0\ (2p_{3/2}^2)^0]^0$. The ^{40}Ar(p,t) experiment unambiguously assigns the 3.383 MeV level in ^{38}Ar a spin 0$^+$ on the basis of its L = 0 angular distribution. The results of the ^{54}Cr(p,d) and ^{53}Cr(p,p') experiments are used in conjunction with the weak coupling model and the models of Maxwell and Parkinson, and Ramavataram to discuss the structure of the low lying levels of ^{53}Cr. An attempt was made to compare the results of this work with the results of other reaction studies whenever possible. Author (NSA)

N67-20836# California Univ., Berkeley. Lawrence Radiation Lab.
NUCLEAR SPINS OF (45 MIN) Cs^{125} AND (13 DAY) Cs^{136}; HYPERFINE-STRUCTURE SEPARATIONS AND NUCLEAR MAGNETIC MOMENTS OF Cs^{125}, Cs^{136}, AND (6.2 HR) Cs^{127}
Osama Bashir Dabbousi (Ph.D. Thesis) 19 Jul. 1966 105 p refs
(Contract W-7405-ENG-48)
(UCRL-16998) CFSTI: HC $3.00/MF $0.65

The nuclear spins and hyperfine-structure separations of 45-min ^{125}Cs and 13-day ^{136}Cs were measured. A more accurate value for the hyperfine-structure separation of 6.2-hr ^{127}Cs was obtained by a least-squares fit of the previously observed resonances and the resonances observed. The nuclear-magnetic moments of these isotopes were calculated from the hyperfine-structure separation with the use of the Fermi–Segre formula. The isotopes ^{125}Cs and ^{127}Cs were obtained by the reactions ^{127}I(α,6n)^{125}Cs and ^{127}I(α,4n)^{127}Cs on iodine. Barium iodide was also used as a target material in the early runs. Iodine or the barium iodide were separated out chemically after bombardment. Plots of the ratios of the activities obtained by bombarding iodine with α particles are given for the α-particle energy range from 63 to 118 MeV. The isotope ^{136}Cs was produced by the reactions ^{136}Xe(d,2n)^{136}Cs and ^{136}Xe(p,n)^{136}Cs on xenon gas with natural isotopic abundance. The activities collected on the buttons during a run were normalized by one of two methods: a hot wire monitored the resonance of the stable Cs carrier, and a side button collected the nonresonance atoms. Both procedures give a relative integrated flux of the beam from the oven during the exposure of a button. Explanation of the nuclear spins and magnetic moments of the cesium isotopes studied is attempted

in the light of present nuclear theories. A brief survey of the nuclear shell model, its extension to deformed nuclei, and the use of pairing plus quadrupole forces for the interaction between the nucleons in the framework of superconductivity theory is given. The theory of the experiment, experimental procedure, modification of the apparatus, targets used for the production of the isotopes, and chemical separation of the isotopes are also discussed. Author (NSA)

N67-20845# Brookhaven National Lab., Upton, N. Y.
NUMERICAL CALCULATIONS OF COUPLING EFFECTS IN A LOW ENERGY PROTON LINAC
R. Chasman [1966] 12 p refs Presented at the Linear Accelerator Conf., Los Alamos, N. Mex.
(Contract AT(30-2)-GEN-16)
(BNL-10669; CONF-661021-2) CFSTI: HC $3.00/MF $0.65

A brief description of numerical calculations on the coupling effects mentioned by Gluckstern, namely coupling between the longitudinal and transverse motions and coupling between transverse motions due to the quadrupole fringing fields is given transverse motions due to the quadrupole fringing fields is given. In the former case, only the influence on the transverse motion was considered. Most of the machine parameters used were present design values of the 200 MeV injector linac for the AGS conversion program. Only $\pm\pm$ quadrupole configurations were considered. No space charge effects were included. NSA

N67-20847# Mound Lab., Miamisburg, Ohio.
STABLE GASEOUS ISOTOPE SEPARATION AND PURIFICATION, JANUARY–MARCH 1966
W. J. Haubach and G. R. Grove 26 Oct. 1966 51 p refs
(Contract AT(33-1)-GEN-53)
(MLM-1352) CFSTI: HC $3.00/MF $0.65

Developments in studies on the separation and purification of stable rare gas isotopes by such methods as thermal diffusion and chromatography are reported, along with thermal diffusion studies on transport properties and intermolecular potentials. A computer program for the calculation of multicomponent isotope separation cascades was applied to krypton. Vapor pressure thermometry research on helium and a helium distillation column are also discussed. NSA

N67-20848# Commissariat a l'Energie Atomique, Saclay (France). Departement de Physique des Particules Elementaires.
SOME GENERAL FEATURES OF TWO BODY REACTIONS IN K^-p INTERACTIONS AT 3 GeV/c [QUELQUES PROPRIETES DES REACTIONS A DEUX CORPS DANS LES INTERACTIONS K^-p A 3 GeV/C]
Jean Badier, Michel Demoulin (Ecole Polytech.), Jacques Goldberg, Roland Barloutaud, D. J. Holthuizen et al (Zeeman Labs., Amsterdam) Jun. 1966 24 p refs In FRENCH
(CEA-R-3037)

The differential and total cross sections of two-body reactions produced in 3 BeV/c K^--proton collisions are presented. Their variation as a function of the baryonic number, strangeness, and isospin of the t and u cross channels is analyzed, as well as some implications of a baryon exchange mechanism. Author (NSA)

N67-20853# Atomics International, Canoga Park, Calif.
AN UPDATED SIXTEEN-GROUP HANSEN–ROACH STRUCTURE LIBRARY
E. H. Ottewitte 12 May 1966 14 p refs
(Contract AT(11-1)-GEN-8)
(NAA-SR-MEMO-11907) CFSTI: HC $3.00/MF $0.65

The contents of a library of revised Hansen–Roach 16-group cross sections are summarized and are discussed. Modified Be and Zr cross sections are included together with Pu^{239} cross sections and cross sections of other elements used in SNAP reactors. NSA

N67-20854# Brookhaven National Lab., Upton, N. Y. Information Div.
EXPERIMENTAL INVESTIGATION OF THE TEMPERATURE GRADIENT EFFECT ON THE DISTRIBUTION OF HYDROGEN IN ZIRCONIUM
V. S. Emel'yanov, N. V. Borkov, A. I. Evstiukhin, and A. T. Kazakevich Oct. 1966 16 p refs Transl. into ENGLISH from Met. i Metalloved. Chistykh Metal., Sb. Nauchn. Rabot (Moscow), v. 5, 1966 p 12–21
(BNL-TR-101) CFSTI: HC $3.00/MF $0.65

An apparatus for obtaining a temperature gradient along the height and radius of cylindrical samples was described. It was determined that under the influence of the temperature gradient the hydrogen in zirconium migrates from the heated to the cooled walls. It was also determined that the curves giving the variation of hydrogen concentration due to the temperature gradient effect indicate a maximal hydration under the specified conditions in those regions, where the temperatue fluctuations are within the limits of 245 to 260°C. Author (NSA)

N67-20868# Iowa State Univ. of Science and Technology, Ames.
SPIN-ONE PARTICLE IN AN EXTERNAL ELECTROMAGNETIC FIELD
Dennis Shay (Ph.D. Thesis) Aug. 1966 54 p refs
(Contract W-7405-ENG-82)
(IS-T-95) CFSTI: HC $3.00/MF $0.65

A single, manifestly covariant wave equation which describes a spin-one particle with anomalous magnetic dipole and anomalous electric quadrupole moments moving in an external electromagentic field is given. In the free particle limit this equation reduces to the covariant Weinberg equations. This particle has mass m, charge e, intrinsic magnetic dipole moment $-e\hbar/4mc$, and intrinsic electric quadrupole moment $e\hbar^2/8m^2c^2$. These two moments correspond to a g factor of 1/2 and a Q factor of $-1/2$. The wavefunction forms a basis for the (1,0) $\otimes$ (0,1) irreducible representation of the Lorentz group. The wave equation has the correct transformation properties under Lorentz transformations, space and time inversion, and charge conjugation. An invariant integral is defined, and from this follows an expression for the matrix element of an arbitrary operator and the time derivative of the matrix element. A method of including external fields in the Bargmann–Wigner equations for spin-one is also given. The resulting equation is essentially the Kemmer equation with fields. Author (NSA)

N67-20870# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of the Theoretical Physics.
SPACE REPRESENTATIONS OF SYMMETRIC GROUPS [O PROSTRANSTVAKH PREDSTAVLENII SIMMETRICHESKIKH GRUPP]
I. V. Polubarinov 1966 22 p refs In RUSSIAN
(JINR-P-2874)

The bases of spaces are constructed in which irreducible representations of symmetric groups S_3 and S_4 operate. The results obtained are useful for physical applications of both finite and continuous groups. Author (NSA)

N67-20872# Joint Inst. for Nuclear Research, Dubna (USSR).
SYSTEM OF COLLECTIVE LEVELS OF $I\pi K=0^+0$ TYPE IN ^{164}ER NUCLEUS [SISTEMA KOLLEKTIVNYKH UROVNEI TIPA $I\pi K=0^+0$ V YADRE ^{164}ER]

Ya. Vrzal, K. Ya. Gromov, Ya. Liptak, F. Molnar, V. A. Morozov et al 1966 38 p refs In RUSSIAN
(JINR-P-2820)

In the study of ^{164}Tm—^{164}Er decay, levels at 1245.5, 1698, 1766.1, 2170.5, and 2185.0 keV of the 0^+ type as well as an octupole level at 1386 keV with $I\pi K = 1^-0$ were identified. Author (NSA)

N67-20873# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Reactions.
SYNTHESIS OF 102 ISOTOPES WITH MASS NUMBERS 254, 253, AND 252 [SINTEZ IZOTOPOV 102 ELEMENTA S MASSOVYMI CHISLAMI 254, 253 I 252]
V. L. Mikheev, V. I. Ilyushchenko, M. B. Miller, S. M. Polikanov, G. N. Flerov et al 1966 19 p refs In RUSSIAN Submitted for publication
(JINR-P-2839)

In bombarding Pu^{242} and Pu^{239} with O^{16} and O^{18} ions, the isotopes 102^{254} ($T_{1/2}$ = 75 ± 15s, E_α = 8.11 ± 0.03 MeV), 102^{253} ($T_{1/2}$ = 95 ± 10s, E_α = 8.01 ± 0.03 MeV), and 102^{252} ($T_{1/2}$ = 4.5 ± 1.5s, E_α = 8.41 ± 0.03 MeV) were synthesized. The isotopes were identified by obtaining the excitation functions and by recording the α decay of the daughter nuclei. Author (NSA)

N67-20874# Staatliche Zentrale fuer Strahlenschutz, Berlin (East Germany).
TABLES OF MAXIMUM ENERGIES OF CHARACTERISTIC β-DECAY [TABELLE WICHTIGER β-MAXIMALENERGIEN]
V. Loessner Apr. 1966 40 p refs In GERMAN; ENGLISH summary
(SZS-4/66)

The maximum energies characteristic of β decays are given for 120 isotopes arranged by order of energy. The table can be used in identifying unknown beta-emitting isotopes if the maximum energy is measured. NSA

N67-20883# Oak Ridge National Lab., Tenn.
NUCLEON TRANSFER IN $^{14}N+^{10}B$ AND $^{14}N+^{40}Ca$ REACTIONS
Jack Gary Couch (Ph.D. Thesis—Texas A&M Univ.) Sep. 1966 128 p refs
(Contract W-7405-ENG-26)
(ORNL-TM-1567) CFSTI: HC $3.00/MF $0.65

The results of an investigation of the neutron-transfer reactions $^{10}B(^{14}N,^{13}N)^{11}B$ and $^{40}Ca(^{14}N,^{13}N)^{41}Ca$ and of the proton-transfer reaction $^{10}B(^{14}N,^{11}C)^{13}C$ are presented. The experimental results are compared with theoretical predictions. NSA

N67-20887# Tufts Univ., Medford, Mass.
HIGH ENERGY PHYSICS AT TUFTS UNIVERSITY Progress Report
J. K. Knipp Sep. 1966 14 p refs
(Contract AT(30-1)-1984)
(NYO-1984-10) CFSTI: HC $3.00/MF $0.65

A progress report is presented on the research activities of the theory; nuclear emulsion, bubble chamber analysis, high energy photons, and nuclear groups at Tufts University for September, 1966. Topics emphasized are study of T violation and form factor in $K_{\mu 3}$ decay, polarization in neutral pion photoproduction, production of polarized photon beams, automatic spark-chamber film reader, and pion lifetime measurements. NSA

N67-20889# Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.
A STUDY OF THE π^+ PROTON INTERACTION AT 3.5 GeV/c [UNE ETUDE DE L'INTERACTION π^+ PROTON A 3.5 GeV/c]
Nhu Hoa Duong (Ph.D. Thesis—Paris Univ.) 1966 79 p refs In FRENCH
(CEA-R-2948)

The π^+ proton interaction leading to two charged outgoing particles has been studied at the incident momentum of 3.2 and 3.5 GeV/c. The pictures were obtained from an exposure of the Brookhaven National Laboratory 20-inch bubble chamber. For the two energies: 1741 events of the reaction $\pi^+ + p \rightarrow \pi^+ + p + \pi^0$, 1100 events of the reaction $\pi^+ + p \rightarrow \pi^+ + \pi^+ + n$ and 4079 events of the reaction $\pi^+ + p \rightarrow \pi^+ + p$ were identified. A study of the exchange mechanism in the N_{33} production is discussed. The resonances $N_{1/2}(1688)$, ρ, η, ω and A1, A2 are observed and discussed. Other results, the elastic interaction and various cross sections are also presented. Author (NSA)

N67-20893# Joint Inst. for Nuclear Research, Dubna (USSR).
MEASUREMENT OF THE TOPOGRAPHY OF THE SYNCHROPHASOTRON MAGNETIC FIELD OF THE JINR BY HALL GENERATOR [IZMERENIE TOPOGRAFII MAGNITNOGO POLYA SINKHROFAZOTRONA OIYAI DATCHIKAMI KHOLLA]
E. A. Dement'ev, I. B. Issinskii, E. M. Kulakova, K. P. Myznikov, M. Polak et al 1966 20 p refs In RUSSIAN
(JINR-P-2818)

The results of measurements of the synchrophasotron magnetic field of the JINR in the average geometric plane are given. The measurements were performed with the help of Hall generator at the magnetic field of 1230 G with the accuracy of ±0.3%. Author (NSA)

N67-20896# California Univ., Berkeley. Lawrence Radiation Lab.
A STUDY OF THE INTERNAL CONVERSION ELECTRONS EMITTED WITHIN THREE NANOSECONDS AFTER THE SPONTANEOUS FISSION OF ^{252}Cf
Rand Lewis Watson (Ph.D. Thesis) Jul. 1966 196 p refs
(Contract W-7405-ENG-48)
(UCRL-19798) CFSTI: HC $3.00/MF $0.65

The spectra of internal conversion electrons of energies between 10 and 650 keV emitted in coincidence with the spontaneous fission of ^{252}Cf were measured and were correlated to fragments of specific masses. A magnetic steering device was used to guide the electrons to a lithium-drifted silicon electron detector shielded against interference from fission fragments, alpha particles, gamma rays, and X-rays. This device also made possible the measurement of the electron spectra in the specific time intervals of approximately 0 to 0.9, 0.1 to 1.7, and 1.1 to 2.9 nsec after fission. The measured spectra showed well-defined structure and were analyzed by means of a least-squares peak-fitting procedure. Many of the lines were identified as K and L conversion line pairs, thus facilitating multipolarity assignments on the basis of K/L ratios. Estimates of intensities and half lives are also given for a large number of the electron lines. By correlating the electron spectra with the gamma measurements of Bowman, it was possible to assign many of the electron lines to specific isotopes. Several of the analyzed electron peaks were suggested to be specific examples of possible 2+ to 0+ transitions in even-even nuclides. Two transitions thought to be associated with ^{110}Ru displayed energies and multipolarities that strongly suggest a region of stable deformation near

mass 110. Binding energy calculations were carried out employing a non-relativistic Hartree–Fock computer program developed by Roothaan. The K and L binding energies of Sr, Pd, Xe, and Sm were calculated as a function of ionic charge ranging from the neutral atom to the fully ionized ion. It was found that the K and L binding energies are both increased over the neutral atomic values by approximately 0.9 KeV for the most probable ionic charges of the fission fragments, and consequently that the K X-ray energies are almost unaffected. Author (NSA)

N67-20898# Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.

MULTI-PARAMETER STUDY OF CAPTURE GAMMAS [ETUDE MULTIPARAMETRIQUE DE γ DE CAPTURE]

Roland Samama, Herve Nifenecker, Pierre Carlos, and Bernard Delaitre Jun. 1966 20 p In FRENCH

(CEA-R-3034)

A description is presented on equipment which is intended for analyzing, recording, and reading simultaneous information from several γ detectors. It allows multiparameter study of γ–γ cascades emitted after thermal neutrons capture. Author (NSA)

N67-20903# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems.

ENERGY SPECTRA AND ANGULAR CORRELATIONS OF PARTICLES IN K [ENERGETICHESKIE SPEKTRY I UGLOVYE KORRELYATSII CHASTITS V]

L. A. Kulyukina, A. N. Mestvirishvili, D. Nyagu, N. I. Petrov et al 1966 11 p refs In RUSSIAN

(JINR-P-2855) CFSTI: HC$3.00/MF$0.65

On the basis of the identified 394 K^0_{e3} decays the electron spectra and the distributions of the angles of electron and π-meson divergence are obtained, when π-mesons are fixed according to the energy in the ranges ΔE=231–270 MeV and ΔE=244–270 MeV. The obtained distributions are well described by vector interactions only. Scalar and tensor variants with the certainty above 99.9% are excluded as a single variant of interaction. Their possible contribution to the interaction is 10–12%. By the experiment no dependence of g_v form-factor on electron energy is found out. Author (NSA)

N67-20906# Stanford Univ., Calif. Linear Accelerator Center.

ELECTRODYNAMIC INTERACTIONS

S. D. Drell Sep. 1966 57 p refs Presented at the 13th Intern. Conf. on High Energy Phys., Berkeley, Calif.

(Contract AT(04-3)-400)

(SLAC-PUB-225; CONF-660808-20) CFSTI: HC$3.00/MF$0.65

Major Experimental Progress is reported in three areas. They are: the electromagnetic form factors of the proton at large space-like and time-like values of the square of the invariant momentum transfer q_2; the photoproduction of electron-positron and muon pairs as high momentum tests of quantum electrodynamics; and the muon g-2 value. The implications for understanding of the hadron form factors and for increasing or delineating the domain of validity of Q.E.D. is considered. Author (NSA)

N67-20908# North Carolina State Coll., Raleigh. Dept. of Mechanical and Aerospace Engineering.

EFFECTS OF GEOMETRY FOR DEPOSITION OF RADIOACTIVE MOLECULES FROM STAGNANT GAS IN CONTAINMENT VESSELS

M. Necati Ozisik and Paul C. Y. Chen Aug. 1966 38 p refs

(Contract AT(40-1)-3414)

(TID-23351; PR-2) CFSTI: HC$3.00/MF$0.65

Effects of geometry on deposition of radioactive molecules from stagnant gas to the vessel walls are theoretically investigated for three different geometries: parallel plates, long cylinder, and sphere. In formulating the boundary value problem, it is assumed that the diffusion flux in the immediate vicinity of the wall surface is proportional to the concentration of radioactive molecules in the gas, and the effects of removal of molecules from the wall surface are also included in the boundary condition. Finite integral transform techniques are employed to reduce the coupled partial differential equations to a single integral equation. For perfect sink condition at the wall surface, analytical solutions are obtained. For imperfect sink condition, the integral equation is represented in the finite difference form, which is then solved with a digital computer for the concentration of radioactive molecules deposited on the wall surface. The general formulation of the problem for the three different geometries investigated are all represented in the same form, but they differed only through the eigen values for use in these relations. It happens that the eigen values for parallel plates are the lowest, and for sphere the highest. Thus, the quantity of deposition at any time for these three different geometries having the same characteristic length is highest for the parallel plates, and lowest for the sphere, the long cylinder having a value between them. Theoretical results of long cylinder model were compared with the experiments obtained from the deposition test performed in a Nuclear Safety Pilot Plant at the Oak Ridge National Laboratory. The agreement between the theory and the experiment was reasonably good. Author (NSA)

N67-20913# Joint Inst. for Nuclear Research, Dubna (USSR).

METHOD OF CALCULATION OF THE CHARGED PARTICLE TRAJECTORY IN THE SYNCHROPHASOTRON MAGNETIC FIELD OF THE JINR [METOD RASCHETA TRAEKTORII VYVEDENNYKH CHASTITS V RASSEYANNOM POLE SINKHROFAZOTRONA OIYAI]

E. M. Kulakova, K. P. Myznikov, L. A. Smirnova, and B. V. Feoktistov 1966 14 p In RUSSIAN

(JINR-P-2880) CFSTI: HC$3.00/MF$0.65

The method is suggested of calculation of the charged particle trajectory in the synchrophasotron magnetic field of the JINR, taking into account nonlinear terms when finding the field components. Author (NSA)

N67-20920# Texas Univ., Austin.

TIME-SHARED ON-LINE COMPUTER-BASED NUCLEAR DATA ACQUISITION SYSTEM

J. G. Page and R. J. Collins Jul. 1966 17 p refs

(Contract AT(40-1)-2972)

(CONF-660913-2; ORO-2972-6) CFSTI: HC$3.00/MF$0.65

A nuclear data acquisition system in operation at the University of Texas accelerator laboratory is described with special reference to the interfacing and programs necessary for time sharing operation. The computer has a short instruction list and is relatively fast. It is equipped with an automatic program priority interrupt system and a data interrupt facility which includes modifications intended to simplify data acquisition and reduction. Connected on-line are two 400-channel pulse-height analysers and three (slow) 1024-channel analog-to-digital converters for use in single- and multiparameter experiments. Remote control panels and several multiplexers which handle the data, program requests, and allow for simultaneous operation of all on-line equipment are included. A time-sharing program handles all on-line program requests for raw data outputs and allows the operation of programs written either in Fortran or source language, or the preparation of new programs simultaneously with data output. NSA

N67-20921# Joint Inst. for Nuclear Research, Dubna (USSR).
NEW Hg ISOTOPES [NOVYE IZOTOPY RTUTI]
A. G. Demin, I. Makhunka, V. G. Subbotin, L. Tron, and T. Fenesh [1966] 18 p refs In RUSSIAN
(JINR-P-2907)

Products of the reactions $^{170}Yb + {}^{20}Ne$, $^{147}Sm + {}^{40}Ar$, and $^{169}Tm + {}^{22}Ne$ were collected by absorption from a stream of He and their α radiation analyzed by a semiconductor spectrometer. The energies of the α particles, half lives of the observed emitters, and excitation functions of the reactions were measured. Five new α groups belonging to new isotopes of Hg were observed. The isotopes observed were ^{179}Hg, ^{180}Hg, ^{182}Hg, and possibly ^{181}Hg and ^{183}Hg. Data were also obtained on the α decay of ^{185}Hg, ^{186}Hg, ^{181}Au, ^{183}Au, ^{185}Au, ^{176}Pt, ^{178}Pt, ^{179}Pt, and ^{180}Pt which are in agreement with known results.
Author (NSA)

N67-20922# Los Alamos Scientific Lab., N. Mex.
NEW TIME-OF-FLIGHT MEASUREMENTS MADE WITH AN INTENSE SOURCE
A. Hemmendinger [1966] 51 p refs Presented at the Intern. Atomic Energy Agency Conf. on Nucl. Data, Paris
(Contract W-7405-ENG-36)
(LA-DC-7813; CONF-661014-5) CFSTI: HC $3.00/MF $0.65

In an experiment in Nevada in June 1965 a nuclear device with a yield equivalent of 1.2 kton of TNT provided the neutron source for time-of-flight measurements over a path of 185 m in vacuo. To exploit the combination of high flux and high energy resolution, new recording techniques were required. Because more than a million data points are acquired in any one exposure of a set of targets, the general problems of data retrieval and processing required special attention. Measurements of fission cross sections of the nuclides ^{233}U, ^{235}U, ^{239}Pu, ^{240}Pu, ^{241}Am, and ^{242}Am are reported. In addition, capture-to-fission ratios of ^{233}U and ^{240}Pu are reported. The neutron energy range is 10 eV to 2 MeV. Individual resonances are resolved in the 100-eV range. Fission data in the resonance region are characterized by lower minima than are reported by most earlier investigators, indicating more favorable signal-to-background ratios. A unique feature of these experiments is the high rate of data acquisition, which allows cross-section measurements on short-lived nuclides. Even for the long-lived nuclides, these experiments provide an abundance of data required in current nuclear technology—data that could otherwise be acquired only by years of tedious measurement.
Author (NSA)

N67-20923# Oak Ridge National Lab., Tenn.
NEUTRON CROSS SECTIONS AND RELATED MEASUREMENTS
J. A. Harvey [1966] 25 p refs Presented at the Seminar on Intense Neutron Sources, Santa Fe, N. Mex.
(Contract W-7405-ENG-26)
(ORNL-P-2493; CONF-660925-2) CFSTI: HC $3.00/MF $0.65

Source-intensity requirements for cross-section measurements with fast neutrons and resonance neutrons are discussed. Cross sections for reactor calculations and for studies of nuclear structure are considered. Multiparameter experiments on nuclear structure are discussed in detail.
NSA

N67-20924# Cornell Aeronautical Lab., Inc., Buffalo, N. Y.
A STUDY OF ALPHA PARTICLE REACTIONS IN ATOMSPHERIC GASES Quarterly Progress Report, 15 May–15 Aug. 1966
Robert A. Fluegge 31 Aug. 1966 11 p refs
(Contract AT(30-1)-3708)
(CAL-VC-2279-P-1; OPR-1; NYO-3708-1) CFSTI: HC $3.00/MF $0.65

Effort expended during the first quarter of this experimental program was directed toward a re-evaluation of the experimental system described in a proposal for a "Study of Charged Particle Interactions with Gaseous Molecules," in a continuing literature search for related experimental findings and in modifying existing equipment so that it will function properly in the proposed experiments.
Author (NSA)

N67-20926# California Univ., Berkeley. Lawrence Radiation Lab.
STUDY OF BRANCH POINTS IN THE ANGULAR MOMENTUM PLANE
Heinz J. Rothe (Ph.D. Thesis) 24 Aug. 1966 123 p refs
(Contract W-7405-ENG-48)
(UCRL-17068) CFSTI: HC $3.00/MF $0.65

A study is made of the Amati–Fubini–Stanghellini (AFS) type of approximation to the amplitudes associated with the exchange of a single Regge pole and an elementary spinless particle, and of two Regge poles, respectively. The location, motion, and nature of the singularities in the complex angular momentum plane of the s reaction which appear in these approximations, and their cancellation in the full diagram, are considered in detail; the singularities are found to be of two general types: branch points whose positions are independent of particle masses, and those which depend on them. Only the former ones determine the asymptotic behavior of the AFS amplitudes in the physical scattering region, while the latter singularities appear only on the physical sheet via the mass-independent branch points at unphysical momentum transfers. The same method used in the study of the AFS approximation to the diagrams which do not have the AFS type singularities is applied to the analysis of the Mandelstam diagrams for which the above-mentioned cancellation of the cuts does not occur. The analysis, although less rigorous, suggests that the location and nature of the singularities in the j plane are the same as those found for the AFS type of approximations to their simpler versions. With a number of approximations which, although plausible, are hard to justify rigorously, an estimate is made of the relative contributions to the amplitude coming from the angular momentum cut and the corresponding Regge pole.
Author (NSA)

N67-20927# Oak Ridge National Lab., Tenn.
FORM FACTORS FOR DWBA CALCULATIONS OF THE $^{54,52,50}Cr(^3He,\alpha)$ REACTIONS LEADING TO ISOBARIC ANALOG STATES
R. Stock, R. Bock (Max-Planck-Inst. fuer Kernphys.), P. von Brentano, and H. H. Duhm [1966] 11 p refs Presented at the Intern. Conf. on Nucl. Phys., Gatlinburg, Tenn. Prepared jointly with Max-Planck-Inst. fuer Kernphys.
(Contract W-7405-ENG-26)
(ORNL-P-2437; CONF-660906-22) CFSTI: HC $3.00/MF $0.65

The reactions $^{50}Cr(^3He,\alpha)$, $^{52}Cr(^3He,\alpha)$, and $^{54}Cr(^3He,\alpha)$ were analyzed at $E(^3He) = 18$ MeV by the DWBA method. It was found that if proper account of the t–T interaction is taken in computing the wave function of the picked-up neutrons to be used as form factors, all the derived spectroscopic factors for both $T - 1/2$ and $T + 1/2$ states are in good agreement with the French–MacFarlane sum rule.
Author (NSA)

N67-20931*# Westinghouse Electric Corp., Pittsburgh, Pa. Astronuclear Lab.
GAM-TNS CROSS SECTION LIBRARY FOR THE N+W REACTIONS
Gordon Gibson and M. Melnick 22 Jul. 1966 88 p refs
(Contract SNP-1)
(NASA-CR-83032; WANL-TME-1472) CFSTI: HC $3.00/MF $0.65 CSCL 20H

The neutron cross sections for ^{182}W, ^{183}W, ^{184}W, and ^{186}W, which were added to the GAM-TNS library, are plotted and are tabulated. Resonance parameters and scattering matrices are also included. The energy range from 0 to 10 MeV is covered. The preparation of the data is discussed. NSA

N67-20932# California Univ., Berkeley. Lawrence Radiation Lab.
GAMMA-VIBRATIONAL BANDS IN ^{182}Os AND ^{184}Os
T. Yamazaki and D. L. Hendrie Jul. 1966 9 p refs Presented at the Intern. Conf. on Nucl. Phys., Gatlinburg, Tenn.
(Contract W-7405-ENG-48)
(UCRL-16986; CONF-660906-23) CFSTI: HC $3.00/MF $0.65

The systematics of the gamma-vibrational bands in even Os nuclei (A=182 to 192) have been obtained from the study of gamma rays from the reactions $^{185}Re(p,2n)^{184}Os$, $^{187}Re(p,2n)^{186}Os$, $^{185}Re(p,4n)^{182}$, and $^{187}Re(p,4n)^{184}Os$. The gamma-vibrational energies obtained were 892 kev in ^{182}Os and 942 kev in ^{184}Os. These results reveal a unique correlation of $\hbar\omega_\gamma$ with the moment of inertia. Author (NSA)

N67-20936# Iowa State Univ. of Science and Technology, Ames.
LEPTON POLARIZATION IN PRODUCTION OF N* BY NEUTRINOS
Hi Sung Song (Ph.D. Thesis) Aug. 1966 68 p refs
(Contract W-7405-ENG-82)
(IS-T-96) CFSTI: HC $3.00/MF $0.65

The differential cross sections for the processes $\nu_1+N\rightarrow N^*+l$ and $\bar{\nu}_1+N\rightarrow N^*+\bar{l}$ are considered for a polarized outgoing lepton. The interaction Hamiltonians are expressed in terms of fourteen form factors. The spin 3/2 polarization and projection operators are obtained. There are four types of terms for the differential cross sections, one depending on momentum transfer only, one proportional to $\bar{M}\cdot\hat{s}$, one proportional to $\bar{N}\cdot\hat{s}\perp$, and one proportional to $(\bar{N}\times\bar{M})\cdot\hat{s}$, where $\bar{N}$, $\bar{M}$, $\hat{s}$, and $\hat{s}\perp$ are the momentum of N*, the momentum of the outgoing lepton, the unit vector along the polarization direction, and the component of $\hat{s}$ perpendicular to $\bar{M}$, respectively. Three different special cases, such as zero outgoing lepton mass, small m_M/E_M and $\bar{N}/m_N$ for the high energy neutrino beam, and transverse polarization of the outgoing lepton, are considered in order to discuss the validity of time-reversal invariance, the current–current form for the interaction Hamiltonian, and γ_5 symmetry for the lepton current. The experimental tests for these four types of terms in the differential cross sections will decide which of the above assumptions for the interaction Hamiltonian is correct. Finally, it is suggested that the consideration of the polarization cross sections might determine which set of the several sets of form factors, obtained by several authors, is the suitable one when the above assumptions for the interaction Hamiltonian are correct. Author (NSA)

N67-20937# Rensselaer Polytechnic Inst., Troy, N. Y.
LINEAR ACCELERATOR PROJECT Annual Technical Report, 1966
Erwin R. Gaerttner et al [1966] 199 p refs
(Contract AT(30-3)-328)
(RPI-328-68) CFSTI: HC $3.00/MF $0.65

Separate abstracts were prepared for the four main sections of the report. The remaining section deals with the effects of electrons of Ge and Si and the measurement of thermal-neutron cross sections of ^{157}Fr and ^{147}Sm using mass spectrometry. NSA

N67-20941# California Univ., Berkeley. Lawrence Radiation Lab.
FLUCTUATIONS OF ENERGY LOSS BY HEAVY CHARGED PARTICLES IN MATTER
Howard David Maccabee (Ph.D. Thesis) 20 Jul. 1966 120 p refs
(Contract W-7405-ENG-48)
(UCRL-16931) CFSTI: HC $3.00/MF $0.65

Significant fluctuations of energy loss are expected in certain cases of the passage of fast heavy charged particles through thin absorbers. When the number of particle-electron collisions in the upper collision-loss interval is small, the energy-loss distribution is asymmetric and is characterized by a broad peak around the most probable energy loss (which is significantly less than the mean energy loss) and by a high-energy-loss tail. Several theories predict the energy-loss distribution function, but previous experimental work is incomplete with respect to verification of theory over the whole significant range of the parameters involved. Beams of 730- and 45-MeV protons, 910-MeV helium ions, and 370-MeV π-mesons were passed through silicon semiconductor detectors of varying thicknesses, and measured the resulting energy-loss distributions. Within the limits of experimental error, there is very good agreement between the measured energy-loss distributions and those predicted by the theory of Vavilov, and good agreement on the value of the most probable energy loss. The results are tabulated and their physical and biological implications discussed. Author (NSA)

N67-20942# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems.
FLUCTUATIONS IN SHOWERS PRODUCED BY 45–330 MeV ELECTRONS [FLYUCTUATSII V LIVNYAKH, OBRAYOVANNYKH ELEKTRONAMI S ENERGIEI OT 45 DO 33 MeV]
O. A. Zaimidoroga, Yu. D. Prokoshkin, and V. M. Taupko-Sitnikov 1966 23 p refs In RUSSIAN Submitted for publication
(JINR-P-2846)

The fluctuations in the electron–proton showers in lead, generated by primary 45-, 130-, and 330-MeV electrons, were studied with a multi-plate cloud chamber. The dependence of the energy loss on the absorber thickness was found for the energy 330 MeV. The half-width of the loss curve changes from 65% for $t=10.2$ g/cm^2 to 30% for $t=49.8$ g/cm^2 and is proportional to $E^{1/2}$. The values of probabilities are obtained for change of the electron number in showers at different absorber thicknesses. It is shown that the changes of the electron number for all energies and absorber thicknesses are satisfactorily described by the Poisson distribution for showers with an even and odd electron number separately. The correlations of the electron number fluctuations are analyzed at different absorber thicknesses. It is shown that the fluctuations strongly damp, passing through a 6–8 g/cm^2 lead layer, irrespective of a primary electron energy and an absorber depth. All the shower characteristics are obtained for the cutoff spectrum energy of secondary electrons of about 1 MeV. Author (NSA)

N67-20943# California Univ., Riverside. Dept. of Physics.
FADDEEV EQUATIONS FOR THE THREE PION FINAL STATE INTERACTIONS IN τ, τ' AND η DECAYS
William A. Dunn and R. Ramachandran [1966] 27 p refs
(Contract AT(04-1)-GEN-12)
(UCR-34P107-35; CONF-660411-61) CFSTI: HC $3.00/MF $0.65

The anisotropy in the pion energy spectra for the various three pion decay modes are assumed capable of providing information concerning the π–π interaction parameters. Such determinations have so far yielded values that radically differ from those obtained from the analysis of low energy pion-nucleon elastic scattering as well as production phenomena. The problem is reconsidered in the light of the complete three body scattering amplitude given according to the description of Faddeev. The assumptions made regarding the kernel of the integral equations include: a simple off shell extension of the two body scattering amplitude, separable in the initial and final momenta; a nonrelativistic framework except

for the pion kinematics; and an attractive s-wave $\pi-\pi$ interaction in the absence of bound states or resonances. Besides the pion scattering length parameters, a momentum cut off exists which, over a wide range of values, has insignificant effect on the shape of the pion energy spectrum. The integral equations are solved numerically and the parameters that best fit the pion spectra for τ, τ', and η decay are obtained. In each case the s-wave scattering length a_2 is found to be much larger than a_0. This confirms that the inclusion of the three particle effects do not significantly alter the general features of earlier works. Author (NSA)

N67-20946# Maryland Univ., College Park. Dept. of Physics and Astronomy.
AN EXPERIMENTAL DETERMINATION OF THE BRANCHING RATIO OF THE Σ^+
F. E. Cecil Sep. 1966 23 p refs
(Contract AT(40-1)-2504)
(ORO-2504-98; TR-621) CFSTI: HC $3.00/MF $0.65

An experiment is described which was designed to determine the branching ratio $\Sigma^+ \to p+\pi^0/(\Sigma^+ \to p+\pi^0)+(\Sigma^+ \to n+\pi^+)$ utilizing a hydrogen bubble chamber exposed to a beam of stopping K^- mesons. NSA

N67-20948# California Univ., Berkeley. Lawrence Radiation Lab.
RECENT PROGRESS IN MESON AND BARYON SPECTROSCOPY.
Arthur H. Rosenfeld May 1966 36 p refs Lectures presented at the Yalta Intern. School on Symmetry of Elementary Particles, Yalta, USSR, 14 Apr.–5 May 1966 Submitted for publication
(Contract W-7405-ENG-48)
(UCRL-16968; CONF-660444-1) CFSTI: HC $3.00/MF $0.65

A report is presented on two of the most notable advances in information on baryons. One is the more complete understanding of the πp system, including the discovery that under the familiar I-spin 1/2 bumps at 1512 and 1688 MeV there are not one but two or three resonances. Results of phenomenologists and theoreticians on this discovery are displayed in the form of partial-wave amplitudes plotted in the complex plane (known as Argand diagrams). The other was the discovery or assignment of three states with spin 7/2. NSA

N67-20949# Los Alamos Scientific Lab., N. Mex.
PRODUCTION OF HEAVY ELEMENTS IN A RECENT LOS ALAMOS THERMONUCLEAR TEST
Darleane C. Hoffman [1966] 8 p refs Presented at Intern. Symp. on Why and How Should We Investigate Nuclides Far Off the Stability Line, Lysekil, Sweden, 1966
(Contract W-7405-ENG-36)
(LA-DC-8103; CONF-660817-3) CFSTI: HC $3.00/MF $0.65

A low-yield thermonuclear device, designed to give a high-neutron-flux region for the purpose of producing heavy elements by multiple-neutron capture, was recently tested underground in Nevada. This device, Cyclamen, containing ^{238}U and ^{243}Am target material, was the most successful heavy element producer to date, giving an order of magnitude more ^{257}Fm than any previous Nevada test. The mass abundance data indicated that still heavier nuclides should have been produced in amounts sufficient to permit detection, but no evidence for them has yet been found. Although it was not expected that the even mass chains would have survived, predicted α half lives for ^{259}Fm and ^{259}Md are ≈20 years and ≈80 days, and it might be expected that their spontaneous fission half lives would be in the range of about a month. However, if it is assumed that these nuclides were produced with an abundance of 1/30th that of the mass 257 chain, present data permit the following half life limits to be set for ^{259}Fm, $t_{1/2}(SF) \leq 5.5$ hr or ≥ 7.5 years and $t_{1/2}(\alpha) \geq 30$ years, and for ^{259}Md, $t_{1/2}(\alpha) \geq 30$ years. The implications of the failure to find evidence for mass 259 are discussed. Author (NSA)

N67-20952# Deutsches Elektronen-Synchrotron, Hamburg (West Germany).
PHOTOPRODUCTION OF SINGLE POSITIVE PIONS BETWEEN 1.2 AND 3 GeV
G. Buschhorn, J. Carroll, R. D. Eandi, P. Heide, R. Huebner et al Sep. 1966 13 p refs Prepared jointly with Hamburg Univ.
(DESY-66/22)

Differential cross sections for the reaction $\gamma+p \to n+\pi^+$ are presented for incident photon energies between 1.2 and 3 BeV and pion center-of-mass production angles of 15 to 50 degrees. Author (NSA)

N67-20953# Joint Inst. for Nuclear Research, Dubna (USSR).
PHASE-SHIFT ANALYSIS OF ELASTIC PION-NUCLEON SCATTERING AT 310 MeV
I. M. Vasilevskii, V. V. Vishnyakov, I. M. Ivanchenko, L. I. Lapidus, I. N. Silin et al 1966 36 p refs In RUSSIAN
(JINR-P-2898)

The SPDF phase-shift analysis has been carried out on the basis of more accurate data on recoil proton polarization in 300 MeV π^--p scattering and of all available data on π-p interactions at this energy. A number of variants of phase-shift analysis has been performed. Information on inelastic interaction, charge exchange scattering, obtained by Caris and Lind, was taken into account. The predictions of dispersion relations for the forward π-N scattering were introduced into the phase-shift analysis. It was shown that the set I which is in general similar to Vik-Rugge set II, statistically is most favorable. Author (NSA)

N67-20955# Princeton-Pennsylvania Accelerator, Princeton, N. J.
ISOBAR PRODUCTION MECHANISMS IN PROTON–PROTON COLLISIONS AT 5 GeV/c
A. P. Colleraine 1 Aug. 1966 161 p refs
(Contract AT(30-1)-2137)
(PPAD-600-F) CFSTI: HC $3.00/MF $0.65

Approximately 7500 4 prong proton–proton collisions at 5 GeV/c have been studied using the BNL 80" hydrogen bubble chamber. The three principal reactions with their cross sections were determined to be: $p+p \to p+p+\pi^+ +\pi^-$, $p+p \to p+p+\pi^+ +\pi^- +\pi^0$, $p+p \to p+n+\pi^+ +\pi^+ +\pi^-$ with cross sections of (2.96±0.12) mb., (1.76±0.07) mb., (2.19±0.09) mb. respectively. In each reaction both single and double N^* production occurs and the decay angular distributions and density matrix elements were calculated whenever possible. These parameters indicate that pseudoscalar exchange appears to be dominant at low momentum transfers and that for higher values of momentum transfer absorptive effects become important. The formation of the eta and the omega meson resonances are observed in the second reaction but in none of the reactions is any significant rho meson production found to occur. Author (NSA)

N67-20962# Los Alamos Scientific Lab., N. Mex.
LOS ALAMOS MESON FACTORY: PRESENT STATUS AND FUTURE PLANS
Donald C. Hagerman [1966] 6 p Presented at the Symp. on Intern. Conf. on Isochronous Cyclotrons, Gatlinburg, Tenn.
(Contract W-7405-ENG-36)
(LA-DC-7642; CONF-660510-4) CFSTI: HC $3.00/MF $0.65

The present status and future plans of the work at Los Alamos Scientific Laboratory on a meson factory project are described. At the time of writing, some 40 scientists and engineers are engaged in research and development activities for this project. The primary emphasis at present is on the linear accelerator which will generate the proton beam for meson production; in the future, this emphasis will shift to research activities connected with the use of the accelerator as a tool of experimental physics. More

detailed descriptions of this work can be found in the quarterly progress reports (LA-3419-MS and following reports). A general description of the accelerator is presented and detailed descriptions of particular research and development activities are included. Author (NSA)

N67-20963# California Univ., Berkeley. Lawrence Radiation Lab.
LOW ENERGY π-π INTERACTION STUDIES FROM K_{E4} DECAYS
Robert W. Birge, Robert P. Ely, Jr., George Gidal, Vasken Hagopian, George E. Kalmus et al 22 Aug. 1966 13 p Presented at the 13th Intern. Conf. on High Energy Phys., Berkeley, Calif., 31 Aug.–7 Sep. 1966
(Contract W-7405-ENG-48)
(UCRL-17088; CONF-660808-14) CFSTI: HC$3.00/MF$0.65

Experimental results are presented on low energy (0 to 160 Mev) π-π interactions from K_{e4} decays and comparisons are made to previous results (Phys. Rev., 139: 6B, B1600(1965)). NSA

N67-20964# Gosudarstvennyi Komitet po Ispolzovaniyu Atomnoi Energii, Moscow (USSR). Inst. Teoreticheskoi i Eksperimental'noi Fiziki.
THREE-PHOTON DECAY OF PARTICLES WITH 0 OR 1 SPIN [O RASPADE CHASTITS SO SPINOM 0 I 1 NA TRI FOTONA]
A. D. Dolgov and L. A. Ponomarev 1966 8 p refs In RUSSIAN; ENGLISH summary
(NP-16329)

General form of the three photons decay amplitude of a scalar particle was obtained. The minimum power of momenta in the matrix element is seven. The general form of the vector particle decay lagrangian with the minimum power of derivatives was built. Author (NSA)

N67-20965# Brookhaven National Lab., Upton, N. Y.
THE RF SYSTEM FOR THE AGS 200-MeV LINAC
J. Sheehan and R. Witkover [1966] 7 p ref Presented at the Linear Accelerator Conf., Los Alamos, New Mexico
(Contract AT(30-2)-GEN-16)
(BNL-10665; CONF-661021-9) CFSTI: HC$3.00/MF$0.65

A new injector for the AGS will be built with a design output current of 100 ma at 200 MeV. A prototype r-f system for this linac is being built as a basis for final design. A description of the system is given. Author (NSA)

N67-20970 Brookhaven National Lab., Upton, N. Y.
SPACE CHARGE EFFECTS IN PROTON LINEAR ACCELERATORS
R. L. Gluckstern (Mass. Univ.) 7 Sep. 1966 12 p refs Presented at the LASL Linear Accelerator Conf., 3–7 Oct. 1966
(Contract AT(30-2)-GEN-16; NSF GP-4476)
(BNL-10668; CONF-661021-9) CFSTI: HC$3.00/MF$0.65

The effects of high space charge on both the longitudinal and transverse motions were investigated in order to see whether these effects will be serious for the particular parameters of the planned 200-MeV linac. NSA

N67-20971# United Kingdom Atomic Energy Authority, Harwell (England).
SOME REMARKS ON A DEFINITE HIGH SOLID ANGLE AND VERY PRECISE α-COUNTER
J. P. Perolat Jan. 1966 16 p Transl. into ENGLISH from the Belgian Rept., 1965
(NP-TR-1428)

A description of a definite high solid angle alpha counter is presented including detector, electronics, vacuum chamber, its geometry, and performance in measuring activity of americium-241. NSA

N67-20972# Oak Ridge National Lab., Tenn.
SOME RECENT NUCLEAR CROSS SECTION MEASUREMENTS AT ORNL, MARCH 1–SEPTEMBER 30, 1966
P. H. Stelson 11 Oct. 1966 21 p refs
(Contract W-7405-ENG-26)
(ORNL-TM-1665) CFSTI: HC$3.00/MF$0.65

Measurements on neutron inelastic scattering by Al, Ca, C, Co, Fe, K, Na, V, and Y; the differential scattering of neutrons by O; the neutron total cross section of N from 2.0 to 4.2 MeV; and the neutron total cross section of ^{40}Ca from 1.0 to 2.1 MeV are summarized. A computer program GRAP for the analysis of neutron-capture gamma spectra is also briefly described. NSA

N67-20973# Gosudarstvennyi Komitet po Ispolzovaniyu Atomnoi Energii, Moscow (USSR). Inst. Atomnoi Energii.
SOME PECULIARITIES OF ION BEAM FOCUSING BY LINEAR STATIONARY FIELDS [NEKOTORYE OSOBENNOSTI FOKUSIROVKI IONNYKH PUCHKOV LINEINYMI STATSIONARNYMI POLYAMI]
Yu. P. Sivkov 1966 15 p refs In RUSSIAN; ENGLISH summary
(NP-16312)

The focusing of ion beams by time-independent fields is viewed as a transformation of four-dimensional phase volumes containing the points representing particles. A system of invariants is established representing the consequences of the integral invariants of the dynamic equation connecting the coefficients of four-dimensional ellipsoids in phase space during a linear simplectic transformation of coordinates. Various pecularities are noted of such transformations and carried out in particular with the separation of the group of ellipses into classes within which simplectic transformations of one ellipsoid into another are possible. NSA

N67-20974# Argonne National Lab., Ill.
SOME MEASURED PROPERTIES OF THE EXTERNAL PROTON BEAM AT THE ZGS
T. A. Romanowski, Y. S. Kim, G. J. Marmer (Ohio State Univ.), P. R. Phillips, E. C. Swallow (Washington Univ., St. Louis, Mo.) et al 12 Aug. 1966 28 p refs
(Contract AT(11-1)-1545)
(COO-1545-13) CFSTI: HC$3.00/MF$0.65

Properties of the extracted beam at the ZGS which were measured are: emittance; beam spot size at both foci when the optimum transport efficiency from the yoke hole to the second focus was obtained; proton extraction efficiency for both long and short spills, for different internal target configurations and for different momenta of the circulating beam; and the time structure of the beam for different operating conditions of the ZGS. NSA

N67-20978# Brookhaven National Lab., Upton, N. Y.
RADIOFREQUENCY BEAM SEPARATOR AT BROOKHAVEN
H. Hahn [1966] 28 p Presented at the Intern. Conf. on Instrumentation for High Energy Phys., Stanford, Calif., 1966
(Contract AT(30-2)-GEN-16)
(BNL-10565; CONF-660918-2) CFSTI: HC$3.00/MF$0.65

The Brookhaven r-f beam separator which was installed together with a beam transport system at the Alternating-Gradient Synchrotron is described. Topics included are the parameters of the r-f separator, deflector, microwave system, counters, and performance. NSA

N67-20979# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy.

RESONANCE LIGHT SCATTERING BY DIATOMIC MOLECULES IN EXTERNAL FIELDS [REZONANSNOE RASSEYANIE SVETA NA DVUKHATOMNYKH MOLEKULAKH, NAKHODYASHCHIKHSYA VO VNESHNIKH POLYAKH]

V. A. Onishchuk and M. I. Podgoretskii 1966 14 p refs In RUSSIAN
(JINR-P-2897)

The external field influence on the intensity of resonance light scattered by diatomic spinless molecules is investigated. Separate lines as well as the whole spectral region are considered. Some formulas are obtained, which may be used for the determination of the characteristics of excited molecular levels such as electric dipole moment, level width, A-splitting value. Author (NSA)

N67-20983# California Univ., Livermore. Lawrence Radiation Lab.

LIVERMORE PROGRAM FOR SEPARATING AND STUDYING THE PRIMARY FISSION FRAGMENTS

P. C. Stevenson, L. A. Cambey, and T. Smith (Nuclide Corp.) Jul. 1966 13 p refs Presented at the Intern. Symp. on Why and How Should We Investigate Nuclides Far Off the Stability Line, Lysekil, Sweden, 21–27 Aug. 1966 Submitted for publication
(Contract W-7405-ENG-48)
(UCRL-14800; CONF-660817-5) CFSTI: HC $3.00/MF $0.65

A program to develop a generally applicable technique for studying in detail the primary products of fission is described. Measurements of the half lives, decay schemes, isobaric chain yields, and average kinetic energies of the primary fission fragments over the entire mass range of fission products are being made. The technique consists in stopping fission fragments in mixtures of highly purified noble gases; transporting the stopped ions out of the reactor; passing them through a differential pumping system into a vacuum; reaccelerating and mass-separating them; and finally studying their yields and decay characteristics by suitable detectors. Information of kinetic energy of a particular isobar is derived from studying the variation of yield with fission source thickness, which gives the range of the fragment in the source material. Information on the chemical nature of the fragments can be deduced from the variation of ionic charge with noble gas mixture, since the ionic charge of the thermalized fragment will depend on the first ionization potential of the most easily ionized gas present. Times from formation of fission fragments to arrival at the detector are predicted to be of the order of a few tens of milliseconds. Equilibrium arrival rates at the detector are estimated to be large enough such that fission products over the mass range from about 75 to about 160 (for ^{236}U) can be investigated. Experimental approaches are reported for the investigation of the generation, stability, and mobility of ions in helium at pressures approaching one atmosphere; of the effect of impurities in the gas, and the methods for achieving adequate helium purity; of the transporting of ions in helium atmospheres over distances of the order of a meter or more; and of the injection of these ions into a mass-separating system. Author (NSA)

N67-20988# Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.

STUDY OF THE RADIATION AROUND A HIGH ENERGY ACCELERATOR. PRODUCTION AND SCATTERING OF CASCADE NEUTRONS [ETUDE DU RAYONNEMENT AUTOUR D' UN ACCELERATEUR DE HAUTE ENERGIE. PRODUCTION ET DIFFUSION DES NEUTRONS DE CASCADE]

Philippe Tardy-Joubert (Ph.D. Thesis—Paris Univ., Orsay, France) 1966 61 p refs In FRENCH
(CEA-R-2975)

The cascade induced in protective screens by a 3 GeV proton beam was studied using activation detectors; the results were compared with the cosmic neutron spectrum in the atmosphere. A study of the secondary neutron spectrum has made it possible to obtain the distribution of the dose and to determine the maximum permissible fluxes expressed in terms of the energy, taking into account all the daughter products present. The dose calculated was checked experimentally. The propagation of cascade neutrons was studied using the idea of an imaginary source. The parameters which have to be introduced into the general equations to take into account scattering in the air were determined. Author (NSA)

N67-20989# Brookhaven National Lab., Upton, N. Y.

SEARCH FOR CP VIOLATION IN THE DECAY $K_S^0 \rightarrow \pi^+\pi^-\pi^0$

D. G. Hill, D. K. Robinson, M. Sakitt, T. C. Bacon, Y. Cho (Carnegie Inst. of Tech.) et al. [1966] 11 p refs Presented at the 13th Intern. Conf. on High Energy Phys., Berkeley, Calif. Prepared jointly with Carnegie Inst. of Tech.
(Contract AT(30-2)-GEN-16)
(BNL-10606; CONF-660808-17) CFSTI: HC $3.00/MF $0.65

An experiment is described in which the neutral K is observed to decay into $\pi^+\pi^-\pi^0$ in the 15 K_S lifetimes, and is tested for large violations of CP which lead to comparable rates for K_S and K_L decaying into three pions. NSA

N67-20992# Princeton Univ., N. J.

SIMPLE BRUECKNER–HARTREE–FOCK CALCULATIONS FOR LIGHT NUCLEI

Chun-Wa Wong Jul. 1966 6 p refs Presented at the Intern. Conf. on Nucl. Phys., Gatlinburg, Tenn., 12–17 Sep. 1966
(Contract AT(30-1)-937)
(PUC-937-223; CONF-660906-34) CFSTI: HC $3.00/MF $0.65

The Hartree–Fock ground-state properties of He^4, O^{16}, and Ca^{40} were calculated by using realistic nucleon–nucleon potentials. The reaction matrix elements were calculated accurately by the reference-spectrum method. The calculations give binding energies in rough agreement with the observed values, underestimating them by about 1 or 2 MeV per particle. However, the calculated equilibrium sizes are approximately correct. Author (NSA)

N67-20996# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics.

PROTON TRANSFER IN A WEAKLY BOUND STATE [O REAKTSII PEREDACHI PROTONA V SLABOSVYAZANNOE SOSTOYANIE]

F. A. Gareev and B. N. Kalinkin 1966 6 p refs In RUSSIAN Submitted for publication
(JINR-P-2794)

The angular distributions of products of proton transfer to weakly bound states in the reactions $V^{51}(C^{12},N^{13})Ti^{50}$ and $Nb^{93}(C^{12},N^{13})Zr^{92}$ were measured. The variation of the proton transfer cross section with the nuclear charge of the target was considered, as was the polarization effect due to the nuclear Coulomb field. NSA

N67-20997# Washington Univ., Seattle.
PROTON SPIN-FLIP IN INELASTIC SCATTERING LEADING TO FIRST EXCITED STATES NICKEL ISOTOPES
F. H. Schmidt, Wojciech A. Kolsinski, and J. G. Cramer. [1966] 4 p Presented at the Am. Phys. Soc. Meeting, Mexico City, N. Mex., Aug. 1966 *Its* Paper DG-3
(Contract AT(45-1)-1388)
(RLO-1388-14; CONF-660811-2) CFSTI: HC $3.00/MF $0.65

Proton inelastic scattering from C^{12}, Ni^{58}, Ni^{60}, and Ni^{64} was studied by measuring the dd-excitation gamma radiation along the axis perpendicular to the scattering plane. According to theory, only gamma radiation arising from ± 1 states lies along that axis, and these states can be excited only by proton spin flip. Measurement of inelastically scattered protons in coincidence with perpendicular gamma radiation was used as a measure of proton spin flip. NSA

N67-20998# California Univ., Berkeley. Lawrence Radiation Lab.
PROTON–PROTON SCATTERING BETWEEN 4.2 AND 10 Mev AND THE $^1S_0$ SHAPE DEPENDENT SCATTERING PARAMETERS
R. J. Slobodrian, H. E. Conzett, E. Shield, and W. F. Tivol Jul. 1966 12 p refs Presented at the Intern. Conf. on Nucl. Phys., Gatlinburg, Tenn., 12–17 Sep. 1966
(Contract W-7405-ENG-48)
(UCRL-16991; CONF-660906-30) CFSTI: HC $3.00/MF $0.65

Proton–proton scattering angular distributions were measured at 6.141, 8.097, and 9.981 MeV (laboratory energy) in an experiment designed to achieve an absolute accuracy better than 1%. A phase shift analysis has produced preliminary values for the $^1S_0$ phase shifts, as well as split P and $^1D_0$ phase shifts. With this new information it is possible to reach substantially less ambiguous conclusions concerning the shape-dependent parameters P and Q than was possible before. Author (NSA)

N67-21001# Princeton Univ., N. J.
PARTICLE PHYSICS Progress Report, Apr. 1965–Apr. 1966
Apr. 1966 47 p refs
(Contract AT(30-1)-937)
(TID-23239) CFSTI: HC $3.00/MF $0.65

Experimental work on the Princeton f-m cyclotron is reported. Improvements in apparatus and optimization of operating conditions are giving higher useable intensity and better energy resolution. Experiments on nuclear reactions are concentrating on the upper reaches of the $1f_{7/2}$ shell. Work is beginning on the next higher shell with pickup reactions and inelastic proton scattering. NSA

N67-21010# Puerto Rico Nuclear Center, Rio Piedras.
TRIPLET SAMPLED RADIATION DAMAGE
S. Z. Weisz, P. Richardson, A. Cobas, and R. C. Jarnagin (North Carolina Univ.) [1966] 34 p refs Presented at the Symp. on Organic Scintillators, Argonne, Ill., 20–22 Jun. 1966 Prepared jointly with North Carolina Univ.
(Contract AT(40-1)-1833)
(CONF-660612-4) CFSTI: HC $3.00/MF $0.65

The emission produced by mutual annihilation of a pair of triplet excitons in single crystalline anthracene was observed to be an indicator of low level γ-dose. Under steady red light illumination the blue emission intensity F_y is related to γ-dose D by $F_y^{-1/2} = a + bD$ in the range 300 to 10^4 R. Independent measurements show the effect cannot be due to changes in absorption in the red region, changes in quantum yield of fluorescence, nor to changes in the specific rate of triplet interaction. An interpretation based on dose induced quenchers and the long range of triplet excitons is given. By use of multiple techniques an individual single crystal of anthracene can be used as a wide range dosimeter: triplet–triplet annihilation in the range 10^2 to 10^4 R, space charge limited photocurrent in the range 10^3 to 10^6 R, fluorescence quenching 10^5 to 10^8 R, and absorption spectroscopy above 10^7 R. Author (NSA)

N67-21020# Societa Ricerche Impianti Nucleari, Saluggia (Italy). Centro Ricerche Nucleari.
PRODUCTION OF CARRIER-FREE Na-24 BY IRRADIATION OF PURE Mg MATRICES IN POOL-REACTORS
R. Malvano, U. Rosa, and P. Grosso Brussels, EURATOM, Dec. 1966 21 p refs
(Contract EURATOM-058-64-6 RISI)
(EUR-3258.e) CFSTI: HC $3.00/MF $0.65

Carrier-free Na^{24} can be produced by irradiating high-purity Mg matrices in the fast-neutron fluxes of pool-reactors: 13 to 26 mC Na^{24} per gram Mg can be obtained for 4-day irradiations in the RS1 reactor. A radiochemical method based on the electrodeposition of the Na^{24} activity on a Hg cathode was developed: 0.5-g amounts of Mg can be processed in 4 hours, with nearly quantitative recoveries (93±5%) and high decontamination factors from the matrix (1.5 to 5×10^3). The procedure is described and the results of some production experiments at mC level are reported. The specific activity obtained when using 99.99% Mg was found to be in the order of 90 C/g, and the radiochemical purity about 99.9%, for 4-day irradiations at 2×10^{13} fast neutron/cm^2 sec, taking into account a 15-hour decay (treatment and delivery time). Author

N67-21022# Brookhaven National Lab., Upton, N. Y.
INELASTIC SCATTERING OF NEUTRONS BY CONDENSED SYSTEMS
L. M. Corliss, ed. Mar. 1966 228 p refs Symp. held 20–22 Sep. 1965
(Contract AT(30-2)-GEN-16)
(BNL-940(C-45)) CFSTI: HC $3.00/MF $0.65

Accomplishments in broad areas of experimental and theoretical activity are reviewed, objectives which might be realized with more powerful neutron sources are suggested, and the effects of high flux reactors on inelastic scattering are considered. For individual titles, see N67-21023 through N67-21050.

N67-21038# Michigan Univ., Ann Arbor. Dept. of Nuclear Engineering.
NEUTRON SCATTERING IN STRETCH-ORIENTED POLYETHYLENE
W. Myers, G. C. Summerfield, and J. S. King *In* Brookhaven Natl. Lab. Inelastic Scattering of Neutrons by Condensed Systems Mar. 1966 p 126–130 refs (See N67-21022 10-24) CFSTI: HC $3.00/MF $0.65

Measurements on stretch-oriented polyethylene held at 100°K have been undertaken in an attempt to identify clearly the frequency limit of the calculated stretch-bend acoustic mode. A simplified "constant-Q" scattering technique was used in order to isolate the longitudinal C–C–C motion. A frequency limit was observed at 525 ± 15 cm^{-1}. The persistence of the torsional mode response in the longitudinal experiment is unexpectedly large. Author (NSA)

N67-21039# General Dynamics Corp., San Diego, Calif. General Atomic Div.
EXPERIMENTAL DETERMINATION OF NEUTRON INELASTIC SCATTERING IN POLYETHYLENE
W. L. Whittemore *In* Brookhaven Natl. Lab. Inelastic Scattering of Neutrons by Condensed Systems Mar. 1966 p 131–137 refs (See N67-21022 10-24) CFSTI: HC $3.00/MF $0.65

High density, crystalline polyethylene is an example of a one-dimensional crystal. Several theoretical treatments have been aimed at generating neutron scattering cross sections: Parks uses a realistic frequency distribution; Goldman, and Koppel and Young use a series of isolated frequencies to approximate the frequency distribution. McMurry has calculated the cross section for n-butane, a significant component of which is the CH_2 radical. The theoretical results have been compared with results obtained by using the General Atomic neutron scattering apparatus and the electron linear accelerator. Monoenergetic neutrons with incident energies of 0.167, 0.233, 0.408, and 0.499 eV were scattered by a "thin" specimen (0.013 inch) of polyethylene at angles of 30°, 60°, 90°, and 150°. Detailed comparisions between experiment and theory reveal that the theories need further adjustment to maximize the fit. In general, the treatment using a distributed frequency distribution gives the better fit to experimental data. All treatments tend to overestimate the strength of the energy levels in the range up to 0.175 eV and to underestimate the strength of the levels around 0.35 eV because of the H–C motion. Author (NSA)

N67-21040# Reactor Instituut, Delft (Netherlands).
INELASTIC NEUTRON SCATTERING BY SOLID AND LIQUID CYCLOHEXANE
L. A. De Graaf *In* Brookhaven Natl. Lab. Inelastic Scattering of Neutrons by Condensed Systems Mar. 1966 p 138–141 refs (See N67-21022 10-24) CFSTI: HC $3.00/MF $0.65

The diffusive motions in liquid and solid cyclohexane were investigated by using the rotating-crystal spectrometer at the Delft reactor. Scattering spectra of the solid at 165°K and of the liquid at 295 and 330°K were measured at 6 different scattering angles between 18 and 80°. The experimental results are compared with the diffusion model of Singwi and Sjölander. Above the phase transition point (186°K) the measured self-diffusion coefficients do not vary appreciably from the value $D = 5.5 \times 10^{-5}$ cm^2/sec determined at 295°K. This indicates that the motion of the protons within a molecule is more important than the motion of the molecule as a whole. Author (NSA)

N67-21041# Michigan Univ., Ann Arbor. Dept. of Nuclear Engineering
INELASTIC SCATTERING OF THERMAL NEUTRONS FROM PRESSURIZED ETHANE
E. A. Straker, J. S. King, J. M. Carpenter, and D. H. Vincent *In* Brookhaven Natl. Lab. Inelastic Scattering of Neutrons by Condensed Systems Mar. 1966 p 142–148 refs (See N67-21022 10-24) CFSTI: HC $3.00/MF $0.65

Inelastic neutron scattering techniques were used to investigate molecular motions of ethane at room temperature. Both liquid and gaseous ethane were studied by means of pressure variation. Data at scattering angles of 90 and 22° were obtained for neutron energies in the range from 0.046 to 0.020 eV on the University of Michigan four-rotor mechanical monochromator. Triple-axis crystal spectrometer measurements for neutron energies of 0.035 and 0.064 eV were also made. These data indicate that there is no significant difference in the scattering properties of ethane in the gas and liquid state. Effects of the torsional motion of the methyl groups about the carbon–carbon bond are evident in the low angle, low energy data but are obscured at the large scattering angle. Comparison of experiment with theory indicates that a Krieger–Nelkin model which includes a harmonic oscillator representation of the torsional motion and the effects of zero-point vibrations predicts the observed data approximately. The influence of multiple scattering on the final energy distribution for both small and large scattering angles was observed and is discussed. Author (NSA)

N67-21042# Phillips Petroleum Co., Idaho Falls, Idaho. Atomic Energy Div.
APPLICATION OF THE LANGEVIN EQUATION TO THE SCATTERING OF NEUTRONS FROM LIQUID METHANE
George W. Griffing *In* Brookhaven Natl. Lab. Inelastic Scattering of Neutrons by Condensed Systems Mar. 1966 p 149–154 refs (See N67-21022 10-24) CFSTI: HC $3.00/MF $0.65

The Langevin equation of Brownian motion is used to analyze the scattering of neutrons by liquid methane. The scattering of a neutron by a molecule in the liquid is formulated similarly to the scattering by a molecule in a gas except that the positional coordinate of the center of mass of the molecule is assumed to obey the Langevin equation. To obtain agreement with the experimental data it is necessary for the viscous damping coefficient η appearing in the Langevin equation to be treated as an adjustable parameter. The minimum momentum transfer in the experiments is 0.8Å^{-1}, and the maximum momentum transfer for which the scattering can be distinguished from that expected for a gas is 2.2Å^{-1}. Plotting the value of η needed to fit the quasi-elastic peak against the above range of momentum transfers on a semilogarithmic graph resulted in a straight line of negative slope. An extrapolation of this straight line to zero momentum transfer gave a value of 1.7×10^{13} sec^{-1} for η, in agreement with the macroscopic experimental value. It is pointed out that the analysis is, at least qualitatively, in accord with the scattering of neutrons by other liquids. There is evidence, although not conclusive, that the rotational motion is partially hindered. Author (NSA)

N67-21043# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
A MODIFIED KINETIC MODEL FOR THE CALCULATION OF $G_s(r,t)$ IN DENSE FLUIDS
Alan G. Gibbs *In* Brookhaven Natl. Lab. Inelastic Scattering of Neutrons by Condensed Systems Mar. 1966 p 155–158 refs (See N67-21022 10-24) CFSTI: HC $3.00/MF $0.65

A model is proposed for the calculation of Van Hove's $G_s(r,t)$ in a classical liquid. The motion of a typical atom is analyzed in terms of the dynamics of an "oscillation," a quasi-particle consisting of the atom plus a surrounding spherical shell representing the collective effect of the instantaneous near neighbors. This shell is assumed to create a harmonic potential well in which the atom oscillates, subject to stochastic forces, while the center of mass moves according to a recently proposed model in which oscillatory motion is neglected. Thus the previous work is generalized to include oscillatory effects, which are found to contribute significantly to $S_s(k,\omega)$, the Fourier transform of $G_s(r,t)$, for intermediate values of k. Comparison with Rahman's calculations for liquid argon shows good agreement for both $\langle r^2(t) \rangle$ and the non-Gaussian effects. Work is at present under way to provide a rigorous derivation of this model, based on the Liouville equation. Author (NSA)

N67-21046# India. Dept. of Atomic Energy, Bombay.
EFFECT OF NUCLEAR SPIN CORRELATION ON THE SCATTERING OF NEUTRONS BY MOLECULES
S. K. Sinha and G. Venkataraman *In* Brookhaven Natl. Lab. Inelastic Scattering of Neutrons by Condensed Systems Mar. 1966 p 169–172 refs (See N67-21022 10-24) CFSTI: HC $3.00/MF $0.65

The scattering of slow neutrons by molecules is usually discussed without considering the restrictions imposed on the molecular wave functions by the presence of identical nuclei in the molecule. Starting from the work of Zemach and Glauber, the theory of neutron scattering is presented taking into account such effects, with special reference to the spherical top molecule. Matrix elements for the scattering between different symmetrized states are evaluated by group theoretical methods. It is shown that the coherent scattering can cause only those transitions which leave

the symmetry of the total molecular wave function unchanged, while incoherent scattering can cause transitions between states of different symmetry. The formulas derived for the cross section are different from those obtained in a recent treatment of the same problem. Calculations for methane were made and are compared with the case in which the effects of nuclear spin correlation are ignored. Author (NSA)

N67-21048# Wien Univ. (Austria). Inst. for Theoretical Physics.
DENSITY EXPANSION OF THE SELF-CORRELATION FUNCTION FOR THERMAL NEUTRON SCATTERING IN DILUTE SYSTEMS
D. J. Sigmar *In* Brookhaven Natl. Lab. Inelastic Scattering of Neutrons by Condensed Systems Mar. 1966 p 175–178 refs (See N67-21022 10-24) CFSTI: HC $3.00/MF $0.65

In inelastic scattering one wants to know the correlation functions $\gamma(\kappa,t) = \langle \exp[-i\kappa\cdot r(0)] \exp[i\kappa\cdot r(t)]\rangle$: $\langle v(0)\cdot v(t)\rangle$. The short-time expansions of these quantities are calculated for Lennard–Jones interaction of the atoms in powers of the density of the system. How the long-time values of these functions can be derived is also discussed. Author (NSA)

N67-21050# Columbia Univ., New York. IBM Watson Lab.
A STATISTICAL EVALUATION OF ELASTIC SCATTERING DATA WITH APPLICATION TO THERMAL NEUTRON SCATTERING IN LIQUID ARGON
Werner A. Schlup *In* Brookhaven Natl. Lab. Inelastic Scattering of Neutrons by Condensed Systems Mar. 1966 p 183–190 refs (See N67-21022 10-24) CFSTI: HC $3.00/MF $0.65

The influence of the counting errors in neutron diffraction experiments on the pair-correlation and the potential following from the Percus–Yevick and the hyper-netted chain equations is discussed for the Henshaw data for liquid argon at 84°K. The results are shown to be very sensitive to the small-angle scattering and the choice of the coherent scattering ratio. The uncertainty in the derived pair potential is of the order of the potential depth. Author (NSA)

N67-21067# Kernforschungsanlage, Juelich (West Germany). Institut fuer Neutronenphysik.
MEASUREMENT OF SCATTERING CURVES IN POLYCRYSTALS AND FLUIDITY WITH $\tau=0$ [MESSUNG VON DISPERSIONSKURVEN IN POLYKRISTALLEN UND FLUESSIGKEITEN MIT $\tau=0$]
B. Dorner Sep. 1966 20 p refs IN GERMAN
(JUL-412-NP) CFSTI: HC $3.00/MF $0.65

Inelastic scattering of neutrons in polycrystals and liquids was studied by determining the dispersion relationship between the phonon frequency ω and its wave vector $\vec{q}$. Assumed was a linear dispersion relationship $\omega = cq$ for the area $\tau = 0$, their intensity was approximated, and an experiment projected that establishes a relationship $\omega(q)$ for the phonon frequency and its wave vector. Transl. by G.G.

N67-21091# Kernforschungsanlage, Juelich (West Germany). Zentralabteilung Strahlenschutz.
ON THE MEASUREMENT OF FLOW INTENSITY AND DOSIMETRY STANDARDIZATION OF INTERMEDIARY NEUTRONS OUTSIDE OF THE SHIELDING FROM NEUTRON SOURCES [UEBER DIE MESSUNG VON FLUSSDICHTEN UND DOSISLEITUNGSAEQUIVALENTEN INTERMEDIAERER NEUTRONEN AUSSERHALB DER ABSCHIRMUNG VON NEUTRONENQUELLEN]
Dieter Nachtigall Apr. 1964 140 p refs In GERMAN
(JUL-158-ST) CFSTI: HC $3.00/MF $0.65

An apparatus with an europium activated Li^6I crystal detector, connected to a photomultiplier and with exchangeable polyethylene spheres on top, was used to determine flux densities in the intermediate and fast neutron energy regions. Spheres were always fastened so that the crystal was positioned right in its centrum. Neutron energies were measured for various diameter spheres and computed for the intermediate energy range. ... Transl. by G.G.

N67-21095# Kernforschungsanlage, Juelich (West Germany). Zentralinstitut fuer Reaktorexperimente.
ABSOLUTE MEASUREMENT OF THE DECAY RATE OF A RADIOACTIVE EMITTER WITH A COMPLEX DECAY SCHEDULE USING A 4 π β–γ COINCIDENCE INSTALLATION. THE ABSOLUTE MEASUREMENT OF Co^{60} AND Co^{58} [ABSOLUTMESSUNG DER ZERFALLSRATE EINES RADIOAKTIVEN STRAHLERS MIT KOMPLEXEM ZERFALLSSCHEMA MIT HILFE EINER 4 π β–γ KOINZIDENZANLAGE. DIE ABSOLUTMESSUNG VON Co^{60} UND Co^{58}]
L. Dieck Jan. 1966 71 p refs In GERMAN
(JUL-355-RX) CFSTI: HC $3.00/MF $0.65

A 4 π β–γ coincidence spectrometer was used to measure the absolute activities of Co^{60} and Co^{58} emitters. Besides the β methane counter, the device also contained two electronic stabilized γ counters, so that γ–γ coincidences could be measured besides the β–γ coincidences. A separated cathode array and relay switches provided the possibility to obtain the upper and the lower β counting rate separately. Absolute measurements on Co^{58} decay produced a higher count for secondary electrons; special corrections established the absolute value with ±1.5% accuracy. Transl. by G.G.

N67-21151# Aktiebolaget Atomenergi, Stockholm (Sweden).
ON THE ATTENUATION OF NEUTRONS AND PHOTONS IN A DUCT FILLED WITH A HELICAL PLUG
E. Aalto and A. Krell Dec. 1966 25 p refs
(AE-261) CFSTI: HC $3.00/MF $0.65

Neutron and gamma ray attenuation has been studied in a cylindrical duct, length/diam. ratio 7, partly (36 vol.%) filled by a helical (screw-like) plug with adjustable number of turns. The total neutron leakage through the duct decreased by a factor of six from zero to 0.5 turn, and by an additional factor of three from 0.5 to 2 turns (saturation value). The leakage with less than 0.5 turn is governed by fast flux and above 0.5 turn by epithermal flux. It is observed that the attenuation calculation in a homogenized, infinite material combined with the predicted attenuation in a duct give the measured saturation attenuation. The length coordinates used must be slightly modified in this case. The attenuation of gamma in the saturation case (~3 turns) equals that predicted without the duct attenuation in a homogenized infinite material. Author (ESRO)

N67-21153# International Centre for Theoretical Physics, Trieste (Italy).
ON THE RELATION BETWEEN TOTAL AND PARTIAL WIDTHS IN NUCLEAR REACTIONS
J. Humblet and A. Lejeune 25 Oct. 1966 13 p refs Submitted for publication
(IC/66/105) CFSTI: HC $3.00/MF $0.65

The ratio between the total width and the sum of the partial widths as defined in the S-matrix theory has been computed for two resonance levels of Be^7 from a simultaneous fitting of the reactions $Li^6(p,p)$, $He^3(\alpha,\alpha)$ and $Li^3(p,\alpha)$. Author ESRO)

N67-21202# International Centre for Theoretical Physics, Trieste (Italy).

SATURATION, STATIC SU(2)-MODEL AND DYNAMICAL SYMMETRIES

L. K. Pande Jan. 1967 13 p refs Submitted for publication

(IC-67-3)

It is shown that the assumption of saturation of certain super-convergence relations by nucleon and the nucleon isobars leads, within the static SU(2)-model, to coupling relations which are identical to those following from the group $SU(2)_I \otimes SU(2)_S \otimes T_9$ with the nucleon and the isobars belonging to the representation of this group which is characterised by $I=J=1/2, 3/2, 5/2, \ldots$. Author (ESRO)

N67-21206# Kernforschungsanlage, Juelich (West Germany). Arbeitsgruppe Institute fur Neutronenphysik.

ON THE DETERMINATION OF THE DIFFUSION CONSTANTS OF H_2O, PHENYSL, $ZrH_{1.26}$, AND D_2O BY NEUTRON SINGLE-SCATTERING EXPERIMENTS

T. Springer, Ch. Hofmeyr, S. Kornbichler, and H. D. Lemmel May 1964 40 p refs

(JUL-60-NP) CFSTI: HC $3.00/MF $0.65

From measurements of the differential scattering cross-section $d\delta(\theta)/d\Omega$ for various neutron energies E and sample temperatures T_m, the average cosine of the scattering angle $\bar{\mu}$, the diffusion constant $D(E,T_m)$, and its thermal average $\langle Dv \rangle_{Tm}$ was calculated. It was found that the scattering cross sections $d\delta/d\Omega$ are not very sensitive to the temperature. Therefore, the quantity $\langle Dv \rangle$ can easily be evaluated within a large temperature range by means of a comparatively small number of $d\delta/d\Omega$-measurements. A qualitative explanation of the very strong interference maxima in the $d\delta/d\Omega$-curves of D_2O can be given. Rather strong coherence maxima have been observed in the phenyl- and ZrH-curves, too. Very good agreement was obtained between our $\langle Dv \rangle$-data and the results of conventional relaxation experiments both with light and heavy water. There was also good agreement with theoretical predictions for H_2O, D_2O, diphenyl, and reasonable agreement with calculations for $ZrH_{1.26}$. The consistency of the results shows that our thermal diffusion parameters $\langle Dv \rangle$ as a function of T_m and the diffusion constant D as a function of E can be considered as reliable for one- or multigroup-calculations. Author

N67-21210# Atomic Energy of Canada, Ltd., Chalk River (Ontario). Chalk River Nuclear Labs.

PHYSICS DIVISION Progress Report, 1 Oct.–31 Dec. 1966

31 Dec. 1966 77 p refs

(PR-P-72; AECL-2659) CFSTI: HC $3.00/MF $0.65

The MP tandem accelerator has been used in nuclear physics experiments. Levels in ^{25}Mg up to 4 MeV and in ^{26}Mg to about 6 MeV have been excited by inelastic scattering of protons from the MP tandem accelerator. Proton bombarding energies between 3.8 and 8.3 MeV were chosen to populate the state under study directly without gamma cascades from higher states. The gamma rays were detected in a 25 cm^3 Ge(Li) spectrometer and lifetimes were measured by observing attenuated Doppler shifts at angles between 20° and 160°. Information on decay schemes was also obtained. Measurements on the first four levels in both ^{25}Mg and ^{26}Mg have been completed and further measurements on higher levels in both nuclei are continuing. A three crystal pair spectrometer consisting of 25 cm^3 Ge(Li) detector surrounded by two NaI(Tl) scintillation detectors has been constructed for studies using the tandem accelerator. Author

N67-21213# Kernforschungsanlage, Juelich (West Germany). Institut fuer Physikalische Chemie.

DETERMINATION OF THE SPECIFIC α-ACTIVITY OF Pu-239 BY USE OF A LIQUID SCINTILLATION COUNTING METHOD [BESTIMMUNG DER SPEZIFISCHEN α-AKTIVITAET DES Pu-239 MIT HILFE EINER FLUESSIGSZINTILLATIONSZAEHLMETHODE]

H. R. Ihle, M. Karayannis, and A. P. Murrenhoff Jan. 1966 38 p refs In GERMAN; ENGLISH summary

(JUL-347-PC) CFSTI: HC $3.00/MF $0.65

By use of an improved liquid scintillation counting method, the specific α-activity of Pu-239 has been determined to be 136400 ± 360 disintegrations $\cdot min^{-1}/ug^{-1}$, which corresponds to a half live of 24350 ± 63 years. The counting method employed has considerable advantages over other methods for the precise determination of specific activities of α-emitters. However, the possibilities to discriminate against β/γ-emitting impurities are limited. Author

N67-21327# Queens Univ., Belfast (Northern Ireland). Dept. of Applied Mathematics.

AN APPLICATION OF THE PARISER–PARR APPROXIMATION TO THE HYDROGEN MOLECULE Scientific Report, 1 Aug. 1964–31 Aug. 1966

U. Opik and T. Howard Thomas (Univ. Coll. of Wales) 17 Dec. 1965 23 p refs

(Contract AF 61(052)-780)

(AFCRL-66-818; SR-12; AD-644514) CFSTI: HC $3.00/MF $0.65

The semi-empirical method due to Pariser and Parr (J. Chem. Phys. v21 p466 1953) is extended to make it applicable to an axially symmetrical molecule. The method is used to calculate, for fixed nuclei, the energies, relative to the singlet-sigma (+) sub G ground term, of those six spectroscopic terms which can be obtained from the ground term by exciting one of the pi-u 2p electrons to a pi-G 2p orbital. Agreement with experiment is satisfactory for those excited states which are not strongly affected by a neglected electronic configuration. Formulae are given for certain valence-state energies, additional to those earlier published (Mol. Phys. v4 p505 1961). Author (TAB)

N67-21328# Queens Univ., Belfast (Northern Ireland). Dept. of Applied Mathematics.

THE DIPOLE SPECTRUM AND PROPERTIES OF HELIUM Scientific Report, 1 Aug. 1964–31 Jul. 1966

Y. M. Chan and A. Dalgarno 31 Jul. 1965 17 p refs

(Contract AF 61(052)-780)

(AFCRL-66-815; SR-9; AD-644511) CFSTI: HC $3.00/MF $0.65

Analytical representations of the dipole spectrum of the ground state of helium are derived. From them are calculated the Verdet constant, the mean excitation energies I and I sub 1 characterising stopping and straggling of a beam of fast particles absorbed in helium and the leading coefficient C(a,b)/(R exp. +6) of the long range interaction between atoms a and b a distance R apart. I is 42.0 eV, I is 73 eV, C(He,He) is 1.471 a.u. and C(He,H) is 2.830 a.u. Author (TAB)

N67-21352# Queens Univ., Belfast (Northern Ireland). Dept. of Applied Mathematics.

VARIATIONAL CALCULATIONS OF LONG RANGE FORCES Scientific Report, 1 Aug. 1964–31 Jul. 1966

W. D. Davison 30 Nov. 1965 23 p refs

(Contract AF 61(052)-780)

(AFCRL-66-817; SR-11; AD-644513) CFSTI: HC $3.00/MF $0.65

The coefficients of the R exp.-4, R exp.-6 and R exp.-8 terms in the series representation of the long range interaction between two atomic systems at separation R are evaluated by a two - centre variational procedure, using highly refined ground state wave functions. Calculations are carried out for all atom - atom and atom - ion pairs drawn from the one- and two - electron systems H, He(+), He, Li(+) and H(-). The values for the R exp.-6 coefficient are in excellent agreement with the values previously derived from oscillator strength data. Author (TAB)

N67-21402 Polish Academy of Sciences, Cracow. Inst. of Nuclear Physics.
A RESONANCE IN THE ELASTIC SCATTERING OF ALPHA PARTICLES ON Ca^{40} NUCLEI [REZONANS W ELASTYCZNYM ROZPRASZANIU CZASTEK ALFA NA JADRACH Ca^{40}]
A. Budzanowski, K. Grotowski, L. Jarczyk, H. Niewodniczanski, and A. Strzalkowski 1966 9 p refs Presented at the Conf. on Nuclear Phys., Gatlinburg, Tenn., Sep. 1966
(NP-502/PL) CFSTI: $3.00

The experimental data on angular distributions for the elastic scattering of alpha particles on Ca^{40} nuclei at different energies from 23.37 MeV to 28.92 MeV were analyzed by means of the optical model. No satisfactory fits were obtained. The agreement could be considerably improved by modifying the phase shifts for the $l=10$ partial waves. Evidence for a resonance at the energy of 24.4 MeV is presented. Author

N67-21405 Polish Academy of Sciences, Cracow. Inst. of Nuclear Physics.
LEVEL STRUCTURE OF Sc^{48} FROM THE $Ti^{50}(d,\alpha)Sc^{48}$ REACTION [STRUKTURA POZIOMOW ENERGETYCZNYCH JADRA ^{48}Sc BADANA W REAKCJI $^{50}Ti(d,\alpha)^{48}Sc$]
K. Grotowski, S. Wiktor, and F. Pellegrini 1966 18 p refs
(NP-491/PL) CFSTI: $3.00

The $^{50}Ti(d,\alpha)^{48}Sc$ reaction was investigated using deuterons with the energy of 12.9 MeV. The energy spectra and angular distributions of α-particles emitted in this reaction have been measured. Relatively large cross-sections were found for transitions leading to the 0.14, 1.06, and 2.03 MeV excited states of the residual Sc^{48} nucleus. The spin and parity values suggested for the 0.14 MeV state and the hitherto not observed 1.06 MeV state are $J^{\pi}=5^+$ and $J^{\pi}=7^+$ respectively. Author

N67-21406 Polish Academy of Sciences, Cracow. Inst. of Nuclear Physics.
THE SUM RULE FOR THE FOUR PION COUPLING CONSTANT RESULTING FROM CURRENT ALGEBRA [ALGEBRA PRADOW I REGULA SUM DLA STALEJ SPREZEZENIA $\pi\pi$]
J. Kwiecinski 1966 11 p refs
(NP-496/PL) CFSTI: $3.00

The sum rule for the off mass shell scattering amplitude at the symmetry point $s=t=u=0$ is derived using the current algebra. This amplitude is assumed to be approximately equal to the four pion coupling constant λ. The sum rule is saturated by the appropriate single particle contributions. The obtained value $|\lambda| \cong 0.15$ is in agreement with other predictions of this constant. Author

N67-21409 Polish Academy of Sciences, Warsaw. Inst. of Nuclear Research.
LATTICE VIBRATIONS IN METALS OF A NON-BRAVAIS STRUCTURE [DRGANIA SIEIOWE METALI Z WIECEJ NIZ JEDNYM ATOMEM W KOMORCE PROSTEJ]
A. Czachor May 1966 21 p refs
(INR-709/II/PS) CFSTI: $3.00

Lattice vibrations in the non-Bravais metal crystals have been treated using thermodynamic Green function methods. A formula for the effective potential of interaction between metal ions has been derived. Possible anomalies, that may appear in the phonon spectrum as a result of the step character of electron distribution at the Fermi surface, have been discussed. Author

N67-21411 Polish Academy of Sciences, Warsaw. Inst. of Nuclear Research.
ON THE SPIN ASSIGNMENT OF NEUTRON RESONANCES IN Sm^{149} USING (n,α) REACTION
M. Dakowski, T. Krogulski, E. Piasecki, H. Piekara, and M. Sowinski Sep. 1966 20 p refs
(INR-755/IA/PL) CFSTI: $3.00

Measurements of thermal neutron cross sections for the Sm^{149} (n,α) Nd^{146} reaction have been made using a 99% enriched Sm^{149} target. Results were compared with theoretical values of cross sections calculated on basis of the compound nucleus and statistical model. Experimental and calculated values are consistent only assuming that spins of bound state and 0.0967 eV resonance in $Sm^{149}+n$ are 3^- and 4^- respectively. Author

N67-21461# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics.
DISPERSION SUM RULE FOR MAGNETIC MOMENTS AND SPIN DEPENDENCE OF PHOTOABSORPTION CROSS SECTIONS [DISPERSIONNOE PRAVILO SUMM DLYA MAGNITNYKH MOMENTOV I SPINOVAYA ZAVISIMOST SECHENII FOTOPOGLOSHCHENIYA]
S. B. Gerasimov 11 Oct. 1966 13 p refs In RUSSIAN Submitted for publication
(JINR-P2-2974)

The spin dependence of the cross sections of the photon absorption by nucleons and the nuclei is discussed on the basis of the dispersion sum rule for the magnetic moments. The estimates obtained show that the spin effect in the photon and nucleon interaction with an energy more than 1 GeV is considered. It is shown with the help of the sum rule that in the Fermi-gas model the anomalous magnetic moment of the bound nucleon increases by 4 to 6% in comparison with the free nucleon. Author (NSA)

N67-21462# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics.
DEGENERATE UNITARY REPRESENTATIONS OF THE SU(2,2) GROUP [VYROZHDENNYE UNITARNYE PREDSTAVLENIYA GRUPPY SU(2,2)]
Cao Chi 1966 10 p refs In RUSSIAN Submitted for publication
(JINR-P5-2950)

Degenerate irreducible unitary representations of the SU(2,2) group are realized in the space of homogeneous functions f(z). Two series of representations (main and additional) were found, each of them is characterized by the pair of numbers (N,x), which are connected with the degrees of homogeneity F and $\dot{F}$ of the function f(z) in the following way $N+2x=F$ and $N-2x=\dot{F}$ and satisfy the definite conditions. Author (NSA)

N67-21466# Oak Ridge National Lab., Tenn.
CALCULATIONS USING THE ALBEDO CONCEPT OF THE SUBCADMIUM FLUX ALONG THE CENTER LINE OF A STRAIGHT, A TWO-LEGGED, AND A THREE-LEGGED SQUARE CONCRETE DUCT ARISING FROM INCIDENT SUBCADMIUM NEUTRONS AND COMPARISON WITH EXPERIMENT
R. E. Maerker and F. J. Muckenthaler [1966] 29 p refs Presented at the 14th Conf. on Remote Systems and Technol., Pittsburgh
(Contract W-7405-ENG-26; DASA Order EO-804-66; DASA Order EO-802-65)
(ORNL-P-2672; CONF-661001-34) CFSTI: HC $3.00/MF $0.65

A brief description of the calculation program is presented and the assumptions inherent in utilizing the albedo concept described. The results are described and compared with experimental ones. NSA

N67-21469# Rice Univ., Houston, Tex.
POLARIZED ^3He TARGETS AND ION SOURCES BY OPTICAL PUMPING

G. K. Walters [1966] 22 p refs Presented at the Conf. on Polarized Targets and Sources, Saclay, France, 5–9 Dec. 1966
(Contract AT(40-1)-1316)
(ORO-1316-17; CONF-661205-1) CFSTI: HC $3.00/MF $0.65

Sizable nuclear spin polarization can be induced in low-density gaseous ^{3}He at room temperature by optical pumping techniques. A number of polarized ^{3}He targets suitable for use in low-energy nuclear scattering experiments were prepared using this technique. The targets are relatively simple and inexpensive to prepare and operate, and they are spectroscopically pure; their primary shortcoming is low density, about 2×10^{17} helium atoms per cc being the current practical upper limit. However, significantly enhanced steady-state nuclear polarization has very recently been achieved in liquid ^{3}He by optically pumping the vapor above it; future improvements in this method may lead to useful dense polarized ^{3}He targets. Considerable progress was also made toward realization of a usable polarized $^3He^+$ ion beam. Ion currents of the order of a microampere were extracted from optically pumped ^{3}He gas in a specially designed rf discharge ion source. Author (NSA)

N67-21477# Columbia Univ., New York. Dept. of Physics.
INTERACTIONS OF MASSLESS SPINORS IN TWO DIMENSIONS
Daniel A. Dubin (New York Univ.) and Jan Tarski [1966] 38 p refs
(Contract AT(30-1)-1932)
(NYO-1932-115) CFSTI: HC $3.00/MF $0.65

The interaction of massless spinors with massive vector mesons ($m_0>0$) in two dimensions is investigated (the vector meson model). Two definitions of the current are considered, and operator solutions employing auxiliary free fields are constructed. However, the presentation is heuristic in part, and the problem of positive definiteness of the theory is left open. The limit $m_0 \to \infty$ is easily obtained; it yields the Thirring model. Some complications are indicated in connection with the limit $m_0 \to 0$, to the Schwinger model. Author (NSA)

N67-21482# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics.
$\Delta S = 1$, $\Delta Q = 0$ DECAYS OF HADRONS IN THE QUARK MODEL [RASPADY ADRONOV S $\Delta S = 1$, $\Delta Q = 0$ V MODELI KVARKOV]
V. K. Ignatovich and B. V. Struminskii 1966 7 p refs In RUSSIAN Submitted for publication
(JINR-P2-2954)

The $\Delta S = 1$, $\Delta Q = 0$ decays of hadrons are considered in the framework of the quark model. The hyperon and meson decays are described by one phenomenological parameter. The decay rates for $\Sigma^+ \to p+\gamma$, $K^+ \to \pi^+ e^+ + e^-$; $K_2^0 \to 2\gamma$ are calculated. The results are in good agreement with experiment. Author (NSA)

N67-21483# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Reactions.
NUCLEAR PROPERTIES OF 102 ISOTOPES WITH MASS NUMBERS 255 AND 256 [O YADERNYKH SVOISTVAKH IZOTOPOV 102-GO ELEMENTA S MASSOVYMI CHISLAMI 255 I 256]
G. N. Akap'ev, A. G. Demin, V. A. Druin, Yu. V. Lobanov, B. V. Fefilov et al 1966 7 p refs In RUSSIAN Submitted for publication
(JINR-P-2938)

New data are given for the half life (≈2 min) and the energy (8.08 MeV) of the α particles for No^{255}, which differ greatly from previously published values. The energy of the α decay of No^{256} was measured for the first time and was found to be 8.58 MeV. Author (NSA)

N67-21484# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics.
NON-COMPACT GROUP REPRESENTATIONS AND ELEMENTARY PARTICLE SYSTEMATICS [PREDSTAVLENIYA NEKOMPAKTNYKH GRUPP I SISTEMATIKA ELEMENTARNYKH CHASTITS]
I. T. Todorov 1966 7 p refs In RUSSIAN
(JINR-P2-2928)

The degenerate discrete series of Hermitian representations of the Lie algebra of U(p,q) are classified. The content of all discrete representations of U(p,q) with respect to the maximal compact sub-group $U(p) \otimes U(q)$ is given. Previous results on hadron mass-spectrum, obtained in the framework of the ladder representations of U(6,6) are discussed. It is mentioned that the mass of the resonance in the $2K_1^+$ system observed recently is quite near to the predicted mass of the scalar singlet in the meson ladder. Author (NSA)

N67-21485# Atomic Energy of Canada, Ltd., Chalk River (Ontario).
PHYSICS DIVISION Progress Report, 1 Jan.–31 Mar. 1966
L. G. Elliott et al 31 Mar. 1966 57 p refs
(AECL-2610; PR-P-69) Available from Atomic Energy of Canada, Ltd., Chalk River: $1.50

A number of energy-level transitions in fluorine were observed by measuring the γ rays emitted following inelastic scattering of 14-MeV neutrons. The 6.02-MeV γ transition from the 7.79-MeV level to the 1.77-MeV level in Si^{28} was observed following excitation by the $Mg^{25}(\alpha,n)Si^{28}$ reaction. Gamma decay of the 8.543-MeV level in Si^{28} was studied from the same reaction. Gamma-ray triple angular correlation measurements were made on levels in Si^{28} and Si^{29} to determine spins and multipole mixtures of the radiations. Alpha spectra from the $O^{16}(O^{16},\alpha)Si^{28}$ reaction were measured to determine spin-parity combinations for Si^{28} levels between 7.38 and 8.94 MeV. Gamma-ray spectra corresponding to the deexcitation of 13 levels in Mg^{24} were analyzed, and the branching ratios to lower levels were determined. Mean lines of 0^+ states in Ce^{140} and Sm^{144} were studied by conversion electron and proton time correlations. Half-life measurements on isomeric Xe^{127} are reported. Experiments were made using two open-ended cylindrical coaxial Ge(Li) detectors for γ–γ coincidence counting. L-subshell intensity ratios are reported for pure E2 transitions in even–even rare-earth nuclei. A half life of 12.31±0.13 y for H^3 was calculated from 5 absolute measurements on AECL H^3 standards dating from April 1953 to March 1966. Studies were made of charge collection times in coaxial Ge(Li) spectrometers. Measurements of the magnetic excitations in UO_2 at temperatures close to the antiferromagnetic transition temperature (28.5°K) were made by neutron inelastic scattering techniques. Measurements of the [ζζζ]L branch of the frequency/wave-vector relation of the normal modes of vibration of the alloy $Nb_{0.44}-Mo_{0.56}$ were made on a triple-axis spectrometer. Neutron scattering by liquid K at 73°C was studied using a rotating-crystal spectrometer. No evidence of phonon-like excitations were observed at this temperature. The inelastic scattering of neutrons from phonons in K at 92°K was measured. Pseudo-potentials were developed for electron–ion interaction in K. Single crystals of $NaNO_2$ were grown by slow cooling of a saturated solution containing a seed crystal. Gamma-ray energies were measured for the reaction $Hg^{199}(n,\gamma)Hg^{200}$ using a coaxial Ge(Li) detector. Similar studies were made for the $Fe^{54}(n,\gamma)Fe^{55}$ reaction using thermal neutrons. Measurements of resonance elastic scattering and self-absorption of γ radiation in natural and radio-lead were performed in the range 5.5 to 8.15 MeV. A technique is described for increasing the efficiency of Ge(Li) detectors, whereby the Compton photons scattered by the Ge crystal are detected by NaI coincidence counters and suitably added to the results. Preliminary results are reported on semiautomatic shell-model calculations for the structure of Si^{28}. NSA

N67-21486# Atomic Energy of Canada, Ltd., Chalk River (Ontario).
STRUCTURE OF A BUNCH OF CHARGED PARTICLES IN AN IDEAL ACCELERATOR
T. D. Newton Jul. 1966 66 p refs
(AECL-2614; FSD/ING-53) Available from Atomic Energy of Canada, Ltd., Chalk River: $1.50

A bunch of charged particles is considered to be moving in a long conducting tube subject to external time-independent focusing forces. The density of particles in the bunch and the electromagnetic field of the bunch of charge in the conducting tube are simultaneously determined. The parameters of the idealized accelerator may be obtained from those of an actual machine design so that predictions of bunch shape and effects of space and image charges on phase areas (emittances) may be made. Author (NSA)

N67-21488# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics.
ON THE THEORY OF RELATIVISTIC SL(6,C) SYMMETRY
Dao vong Duc, L. Enkovski, V. V. Kukhtin, I. Montvai, and Nguyen van Hieu 1966 26 p refs Submitted for publication
(JINR-E2-2951)

The technique of SL(6,C) symmetry with infinite multiplets is developed. Using homogeneous functions, the unitary representations of SL(6,C) are constructed. The decomposition of these representations into SU(6) multiplets and $SU(6)_p$ (physical) multiplets is investigated and the invariant meson–baryon vertex is constructed. For the vertex the connection between the theory with infinite multiplets under consideration and the nonunitary theory of intrinsically broken SL(6,C) symmetry is established. Author (NSA)

N67-21489# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Reactions.
TERNARY FISSION OF U^{238} INDUCED BY NEON IONS
G. N. Flerov, S. A. Karamyan, I. V. Kuznetsov, Yu. Ts. Oganesyan, and Yu. E. Penionzhkevich 1966 13 p refs Submitted for publication
(JINR-E7-2924)

Ternary fission has been investigated while bombarding U^{238} with 190-MeV Ne^{22} ions. The ratio of the ternary fission cross section to the binary fission one is within the limits $5 \times 10^{-6} < \sigma_{3F}/\sigma_{2F} < 10^{-4}$. The total kinetic energy of the fission fragments is about 250 MeV. The experiments were performed in the 310-cm JINR cyclotron. Author (NSA)

N67-21490# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems.
RESTRICTION OF THE BEAM CURRENT BY SPACE CHARGE IN THE JINR SYNCHROCYCLOTRON [OGRANICHENIE TOKA PUCHKA PROSTRANSTVENNYM ZARYADOM V SINKHROTSIKLOTRONE OIYAI]
V. I. Danilov, I. V. Puzynin, A. N. Safonov, and B. V. Feoktistov 1966 33 p refs In RUSSIAN
(JINR-P-2912)

The size of the beam at the beginning of acceleration for the synchrocyclotron and the Coulomb force components of the beam are calculated. Critical currents are found which are held in the beam by all the focusing forces and can be accelerated at the dee voltage 18 kV. Author (NSA)

N67-21491*# California Univ., Berkeley. Lawrence Radiation Lab.
SECONDARY-ELECTRON DISTRIBUTION FOR HEAVY IONS
Nobuo Oda and John T. Lyman Sep. 1966 28 p refs Presented at the Workshop Conf. on Space Radiation Biol., Berkeley, Calif. Submitted for publication Sponsored in Part by NASA Revised
(Contract W-7405-ENG-48)
(NASA-CR-83130; UCRL-16405, Rev.; CONF-650924-6, Rev.) CFSTI: HC $3.00/MF $0.65 CSCL 20H

Two kinds of approaches to the δ-ray correction for heavy ions are discussed: space-averaged picture and extended-track picture. The fundamental quantity for the space-averaged picture is the differential flux (slowing-down spectrum) $\phi_d(E)$ of δ rays. Experimental results are presented on the energy spectra and absolute yield values of the low-energy part of $\phi_d(E)$. The most interesting results are as follows: (1) when the velocities of primary ions are the same, the yields for each kind of ion are proportional to dE/dx and (2) when the velocities are different for each kind of ion, the specific yield for higher velocity is higher than that for lower velocity. The discussion of several related problems suggests the importance of studies on the behavior of energy spectra of the secondary-electron flux. Author (NSA)

N67-21502# India. Dept. of Atomic Energy, Bombay.
STUDY OF THE EFFICIENCY OF A GETTER-ION PUMP
K. B. Nambiar and A. S. Divatia 1966 11 p refs
(AEET-249)

Efficiency of a getter–ion pump developed at the Van de Graaff Laboratory was studied. Outgassing of the system, performance of the getter and the distrubution of the getter material inside the pump chamber are factors which influence the efficiency. Baking of the pump chamber was found essential for attaining lower ultimate pressures and better pumping efficiency. Various getters were tried in the pump and it was found that titanium is superior to all the others. Author (NSA)

N67-21513# Atomic Weapons Research Establishment, Aldermaston (England).
THE MULTIGROUP NEUTRON TRANSPORT PERTURBATION PROGRAM DUNDEE
Pamela C. E. Hemment, E. D. Pendlebury, M. J. Adams, B. A. Brett, and D. Sams Oct. 1966 51 p refs
(AWRE-O-40/66) HMSO: 8s

A description is given of the IBM 7030 (Stretch) program Dundee which has been written to facilitate the application of first order perturbation theory to problems in multigroup neutron transport theory. It uses as part of its input perturbation functions (on tape) calculated by the S_n program Straint, and can be used in particular to calculate the sensitivity of the inverse reactivity B, and time constant λ to changes in the cross section data. Author (NSA)

N67-21517# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Reactions.
NEW ISOMERS La^{129m} AND La^{130m} [NOVYE IZOMERY La^{129m} I La^{130m}]
V. Nolbert, Kh. Brinkmann, Kh. Rotter, K. Aleksander, and Kh. Khaizer 1966 17 p refs In RUSSIAN
(JINR-P7-2966)

Two previously unreported isomeric states in ^{129}La and ^{130}La were observed. The isomeric state in ^{130}La identified from the cross bombardings $^{122}Sn + ^{14}N$ and $^{123}Sb + ^{12}C$ decays by a 95 ± 5 keV gamma transition with a half life of 9.2 ± 0.5 10^{-3} sec. The isomeric state in ^{129}La excited via the heavy ion bombardments $^{118}Sn + ^{14}N$, $^{119}Sn + ^{14}N$, $^{120}Sn + ^{14}N$, and $^{121}Sb + ^{12}C$ has a half life of 0.56 ± 0.05 sec and decays by emission of two gamma rays with 67.5 ± 0.5 and 104 ± 1 keV, respectively. To identify the activity, excitation functions were measured. They have

the typical form of pure neutron evaporation. Other reactions of the type (^{14}N,axn) and (^{14}N,pxn) were excluded by properly chosen cross bombardments ^{118}Cd + ^{15}N and ^{120}Sn, ^{122}Sn + ^{12}C and critical absorption measurements of the X-ray. Author (NSA)

N67-21518# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics.
PARTICLE DECAYS IN THE THEORY WITH NONCOMPACT GROUPS [O RASPADAKH CHASTITS V TEORII SIMMETRII S NEKOMPAKTNYMI GRUPPAMI]
O. G. Bokov, E. Mikhul, and B. Sredniava 1966 11 p refs In RUSSIAN Submitted for Publication
(JINR-P2-2947)

The SL(2,C) group is considered as the internal symmetry group. The vector-coupling coefficients for the irreducible unitary representations of SL(2,C) are calculated. The matrix element for the decay of a spin-1 particle into two spinless particles is calculated. Author (NSA)

N67-21519# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics.
STATISTICAL MODEL OF MULTIPLE PARTICLE PRODUCTION IN BROKEN UNITARY SYMMETRY [STATISTICHESKAYA MODEL MNOZHESTVENNOGO OBRAZOVANIYA CHASTITS V NARUSHENNOI UNITARNOI SIMMETRII]
V. S. Barashenkov, G. M. Zinov'ev, and V. M. Mal'tsev 1966 11 p refs In RUSSIAN Submitted for publication
(JINR-P2-2956)

A statistical model with breaking unitary symmetry is proposed. The calculations are performed taking into account the splitting of the effective coupling constant which is due to differences between the interactions of the K-mesons and other particles. The results are compared with the experimental data. A noticeable disagreement is seen only in the case of the channel with small number of particles. To study them a more delicate approach is needed. Author (NSA)

N67-21521# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics.
THE HIGHEST CORRECTIONS TO THE POSITRONIUM GROUND STATE LEVEL DISINTEGRATION, I [VYSSHIE POPRAVKI K RASSHCHEPLENIYU OSNOVNOGO UROVNYA POZITRONIYA. I.]
Yu. N. Tyukhtyaev and R. N. Faustov 29 Sep. 1966 8 p refs In RUSSIAN Submitted for publication
(JINR-P2-2949)

With the help of the quasipotential equation the contributions from the second and fourth-order diagrams in the positronium ground-state level disintegration are calculated with an accuracy of the sixth order relative to the fine structure constant α. Author (NSA)

N67-21523# Los Alamos Scientific Lab., N. Mex.
DESIGNING RESONANT CAVITIES WITH THE LALA COMPUTER PROGRAM
H. C. Hoyt [1966] 17 p Presented at Linear Accelerator Conf., Los Alamos, N. Mex.
(Contract W-7405-ENG-36)
(LA-DC-8255; CONF-661021-27) CFSTI: HC $3.00/MF $0.65

Cavity design studies using the LALA computer program are reported. The three studies included are concerned with β=0.65 proton linac cavities, β=1 electron linac cavities, and the cavity in the coaxitron microwave amplifier tube. NSA

N67-21525# United Kingdom Atomic Energy Authority, Harwell (England). Rutherford High Energy Lab.
ELECTROSTATIC GENERATOR GROUP Final Report
W. D. Allen and R. H. V. M. Dawton Sep. 1966 74 p refs
(RHEL/R-120) HMSO: 15s

The progress report written in 1962 and 1963 on the Oxford Electrostatic Generator Project is completed with a description of the performance of the injector as a whole and of operation coupled with a tandem. NSA

N67-21526# California Univ., Berkeley. Lawrence Radiation Lab.
EQUILIBRIUM PROPERTIES OF BOSON SYSTEMS AT LOW TEMPERATURES
Victor Kenneth Wong (Ph.D. Thesis) 28 Sep. 1966 282 p refs
(Contract W-7405-ENG-48)
(UCRL-17159) CFSTI: HC $3.00/MF $0.65

A study of the equilibrium properties of boson systems at low temperatures with particular emphasis on the Bose–Einstein transition and restricted geometry is undertaken both from the microscopic and the macroscopic viewpoints. Use of the Green's function formulation enables the systematic study of essentially all microscopic models in the literature. In particular the zeroth-order approximation is the Ideal Bose gas, which is applied to the problem of restricted geometry. The first-order approximations include the Bogoliubov/Ideal, Hartree, Bogoliubov/Hartree, Hartree–Fock, and Bogoliubov/Hartree–Fock approximations. With the sole exception of the Hartree, the first-order approximations display a double-valued behavior in the number density and other thermodynamic functions. Application to restricted geometry results in the same problem as with the Ideal Bose gas, namely that the macroscopic occupation, i.e., the Bose–Einstein condensation, does not strictly appear in restricted geometry. The second-order approximations include the Belyaev/Hartree–Fock, Born-collision, Bogoliubov/Born-collision, Belyaev/Born-collision approximations. The Born-collision approximation is considered, and it is shown that it gives a logarithmic singularity to the specific heat in the Very Dense State limit. The Born-collision approximation is applied to restricted geometries by a variational technique. From the macroscopic viewpoint, it is shown that the Ginzburg–Pitaevskii theory can yield only second-order transitions in film geometries as well as in bulk systems. Based on symmetry considerations, a new, modified theory is proposed in which the order function is identified with the "anomalous" self-energy, which is motivated by a microscopic argument. The new theory is shown to agree with the experimental behavior of the superfluid mass density and the jump in the specific heat, to satisfy the exponent scaling laws, to give a third-order transition in film while giving a second-order in bulk, and to yield shifts in the transition temperature in agreement with experimental observations. Author (NSA)

N67-21527# California Univ., Berkeley. Lawrence Radiation Lab.
CROSS SECTIONS FOR ELECTRON CAPTURE BY FAST PROTONS IN H_2, He, N_2, Ar
Leland Merritt Welsh (Ph.D. Thesis) 30 Aug. 1966 61 p refs
(Contract W-7405-ENG-48)
(UCRL-16765) CFSTI: HC $3.00/MF $0.65

Measurements were made of cross sections for electron capture by protons, from 440 keV to 13.75 MeV in N_2 and in Ar; to 5.41 MeV in He; and to 2.45 MeV in H_2. These results are presented, along with electron-loss cross sections for the same gases at 1.027 and 2.44 MeV. The measurements were carried out through analysis of particle beam composition after exit from a gas target of known composition and thickness. The beam was separated magnetically, and the charged and neutral components were detected by Faraday cup and scintillator, respectively. Author (NSA)

N67-21529# Deutsches Elektronen-Synchrotron, Hamburg (West Germany).
REVIEW OF THE EXPERIMENTAL PROGRAM AND THE FIRST RESEARCH RESULTS WITH THE GERMAN ELECTRON SYNCHROTRON [UEBERSICHT UEBER DAS EXPERIMENTALLE PROGRAMM UND DIE ERSTEN FORSCHUNGSERGEBNISSE BEIM DEUTSCHEN ELEKTRONEN-SYNCHROTRON]
U. Meyer-Berkhout 20 Mar. 1966 46 p In GERMAN Presented at the Session on Nucl. Phys. Panel, Bad Freudenstadt, West Germany, 24 Mar. 1966
(NP-16354)

A review is given of the experimental program of DESY during the years 1965 and 1966. Some of the research results obtained on photoproduction experiments, electron scattering experiments, experiments on the testing of the validity limits of quantum electrodynamics, and special studies falling in none of the other classes are discussed. Preliminary results were reported on photoproduction processes in a H_2 or D_2 bubble chamber in the photon energy range between 0.3 and 5.8 GeV, photoproduction of dipions and electroproduction of pions, single photoproduction of π^0 and η^0 mesons under forward angles, single photoproduction of π^+ and K^+ mesons at small angles, photoproduction of antiprotons, elastic and inelastic e–p and e–d scattering, systematic search for the production of a heavy electron in e–p collisions, quasielectric e–d scattering, wide-angle electron–positron pair production by photons, investigation of bremsstrahlung intensity spectra using a pair spectrometer, production of coherent bremsstrahlung by irradiation of a diamond crystal with fast electrons, and experiments with the synchrotron radiation in vacuum in the uv and x range up to 300 keV. NSA

N67-21531# Oak Ridge National Lab., Tenn. Health Physics Div.
CALCULATION OF RADIATION DOSE DUE TO HIGH-ENERGY PROTONS
Harvel Wright, E. E. Branstetter, Jacob Neufeld, J. E. Turner, and W. S. Snyder [1966] 18 p refs Presented at 1st Intern. Congr. of the Intern. Radiation Protect. Assoc., Rome
(Contract W-7405-ENG-26)
(ORNL-P-2568; CONF-660920-11) CFSTI: HC $3.00/MF $0.65

Results are presented that were obtained in a continuing study of the dosimetry of high-energy protons. Studies in high-energy proton dosimetry are of interest in assessing the potential radiation hazards for manned space flight and are also of interest for radiological protection in the vicinity of high-energy accelerators and for biological irradiation experiments. The present calculations consider the dose deposited in tissue by protons with energies from 400 MeV to 2 GeV. Some of the results dealing with the dose due to protons with energies up to 400 MeV were reported previously. For proton energies below 400 MeV, the production of pions in the cascade process was not sufficiently common to be considered significant. However, in the present calculations it is necessary to take pions into account. The basic quantity of interest in dosimetry is the absorbed dose, defined in units of the rad where 1 rad is equal to 100 ergs/gram. In order to calculate the dose equivalent, one specifies a quality factor (QF) which is often related to the values of linear energy transfer (LET) at which the energy deposition takes place. This QF–LET relation is then used to determine the dose equivalent. The dose and dose equivalent was calculated in each sub-slab of a phantom having the form of a slab 30 cm thick and infinite in lateral extent. Computer calculations were made to provide absorbed dose and dose equivalent data. NSA

N67-21537# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics.
QUANTUM MECHANICAL PROBLEM OF THREE BODIES INTERACTING ACCORDING TO THE COULOMB LAW [KVANTOVOMEKHANICHESKAYA ZADACHA 3-x TEL, VZAIMODEISTVUYUSHCHIKH PO ZAKONU KULONA]
L. I. Ponomarev 1966 13 p refs In RUSSIAN
(JINR-P4-3011)

Some results of calculation of the matrix elements using the wave functions of two-body problem are given. These matrix elements permit the solution of many problems of quantum mechanics in another way. Possible applications of the obtained results to the description of the processes involving three bodies, which interact according to the Coulomb law, are discussed. As an example the binding energy of the $e^+e^-e^+$ system is calculated. Author (NSA)

N67-21538# Cornell Aeronautical Lab., Inc., Buffalo, N. Y.
A STUDY OF ALPHA PARTICLE REACTIONS IN ATMOSPHERIC GASES Quarterly Progress Report, 16 Aug.–15 Nov. 1966
Robert A. Fluegge 30 Nov. 1966 5 p
(Contract AT(30-1)-3708)
(CAL-VC-2279-P-2; QPR-2; NYO-3708-2) CFSTI: HC $3.00/MF $0.65

Primary and subsequent events that occur as a result of gas bombardment by alpha particles will be investigated during the experimental portions of the program. The vacuum and electronics system modifications were completed and preliminary testing of each was undertaken. The alpha particle energy spectrum measured for the Am-241 source and associated 0.0002" stainless steel window is presented. The energy scale was estimated using the absorption characteristics of stainless steel; the calibration was not absolute. A block diagram of the experimental system that has evolved from the preliminary testing is presented. NSA

N67-21543# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Reactions.
EFFECTIVE RESOLVING TIME IN COINCIDENCE MEASUREMENTS ON THE CYCLOTRON BEAM
A. Z. Khrynkevich, S. Kopta, S. Shimchik, and T. Val'chak 1966 17 p refs Submitted for publication
(JINR-E13-2926)

The influence of the hf pulsation of the cyclotron beam and of its modulation caused by the duty cycle on the resolving time in coincidence measurements is taken into account. Formulas for the effective resolving time in gamma-gamma, gamma-particle, and particle-particle coincidence measurements for different ratios of the electronic resolving time to the width of hf bunches and to their repetition period are given. It is shown that the delayed chance coincidence curve can be used for the determination of the cyclotron bunch width. This conclusion was checked by a measurement performed on the beam of the heavy ion cyclotron of the JINR in Dubna. Author (NSA)

N67-21548# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems.
NEW ISOTOPES ^{176}Re AND ^{175}Re [NOVYE IZOTOPY ^{176}Re I ^{175}Re]
E. Nadzhakov, N. Nenov, N. G. Zaitseva, G. Pfrepper, and D. Khristov 1966 8 p refs In RUSSIAN Submitted for publication
(JINR-P-2910)

New isotopes ^{176}Re and ^{175}Re were obtained when bombarding Ho targets with ^{16}O ions and Tb targets with ^{22}Ne ions. They were identified by the genetic connection with the W and Ta daughter isotopes, as well as by some rotational ^{176}W levels known from the reaction. The half lives were determined to be (5±1 min) for ^{176}Re and (5±1 min) for ^{175}Re. Author (NSA)

N67-21549# Polish Academy of Sciences, Warsaw. Inst. of Nuclear Research.
ON THE LOWER LIMIT OF TRANSVERSE MOMENTUM AND FOUR-MOMENTUM TRANSFER OF RECOIL PROTONS IN NUCLEON-NUCLEON INTERACTIONS OF ENERGIES ABOVE 10^{12} eV
J. Babecki Jul. 1966 16 p refs Submitted for publication
(INR-736/VI/PH)

The determination of transverse momentum and four-momentum transfer of recoil protons in nucleon-nucleon interactions of ultra high energy on the basis of kinematical analysis of angular distributions of secondaries in cosmic ray jets is described. The method applied consisted in calculating the transverse momentum for all relativistic tracks assuming that the given track is due to a proton and in the selection of the smallest value out of all possible values of $p_\perp$. Author (NSA)

N67-21550# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics.
EQUILIBRIUM DEFORMATIONS OF HEAVY NUCLEI CALCULATED WITH PROJECTED WAVE FUNCTIONS
A. Sobichevski 1966 21 p refs Submitted for publication
(JINR-E4-2934)

The ground-state equilibrium deformations, electric quadrupole moments, and deformation energies are calculated for even nuclei in the heavy element region. Projected wave functions (PBCS) corresponding to a definite number of particles are used. It is found that the main effect of using the PBCS wave functions instead of the BCS ones appears at the beginning of the region and consists in the earlier appearance of the deformation and in the large values of it. Author (NSA)

N67-21551# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics.
DEPENDENCE OF THE GROUND STATE ENERGY AND QUADRUPOLE MOMENT ON DEFORMATION FOR HEAVY NUCLEI
I. N. Kukhtina and A. Sobiczewski 1966 22 p refs
(JINR-E4-2940)

The ground-state energies and the ground-state quadrupole moments are calculated as functions of the deformation for even nuclei in the heavy element region. The projected wave functions corresponding to a definite number of particles are used. The results obtained with the wave functions obtained by Bardeen, et al. [Phys. Rev. 108: 1175(1957)] and in the independent-particle approximation are also presented for completeness. Author (NSA)

N67-21552# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics.
DISPERSION SUM RULES AND THE HYPERON MAGNETIC MOMENTS
V. G. Pisarenko 1966 9 p refs Submitted for publication
(JINR-E2-2931)

The values of the hyperon magnetic moments are obtained from the dispersion sum rules for the virtual photoproduction of the pseudoscalar mesons on baryons. The results are in agreement with the SU(3) predictions and are compared with the experiment. Author (NSA)

N67-21556# Brookhaven National Lab., Upton, N. Y.
BROOKHAVEN'S RECENT PREACCELERATOR PROGRESS
Th. J. M. Sluyters 29 Sep. 1966 18 p refs Presented at the 1966 Linear Accelerator Conf., Los Alamos, N. Mex.
(Contract AT(30-2)-GEN-16)
(BNL-10651; CONF-661021-18) CFSTI: HC$3.00/MF$0.65

The new BNL linac preaccelerator is discussed in two sections: the ion source and beam performances measured at extractor voltage (≈40 kV); and the accelerating tube, high voltage behavior and beam performances measured at 750 kV. NSA

N67-21557# Bettis Atomic Power Lab., Pittsburgh, Pa.
MAR-1, A FORTRAN IV PROGRAM FOR CONSTRUCTION FROM MULTIGROUP CROSS SECTIONS OF COMPATIBLE CROSS SECTION DATA IN FINE ENERGY DETAIL AND FOR ADDITION OF THESE DATA TO THE ROC NUCLEAR DATA LIBRARY TAPE
D. R. Harris and C. B. Noll Apr. 1966 13 p refs
(Contract AT(11-1)-GEN-14)
(WAPD-TM-598) CFSTI: HC$3.00/MF$0.65

The computer program MAR-1, a FORTRAN IV program for constructing cross-section data in fine energy detail from multigroup cross-section data, is described. The multigroup data are drawn from the MILC library tape, and the computed fine detail data are punched on cards for input to the ROC-1 program which adds the data to the ROC nuclear data library tape. NSA

N67-21558# California Univ., Berkeley. Lawrence Radiation Lab.
MEASUREMENT OF POLARIZATION PARAMETER IN NEGATIVE PION PROTON SCATTERING FROM 229 TO 390 MeV
John Frederic Arens (Ph.D. Thesis) Sep. 1966 49 p refs
(Contract W-7405-ENG-48)
(UCRL-17153) CFSTI: HC$3.00/MF$0.65

The π^-p polarization parameter was measured at several energies and angles using a polarized proton target at the 184-in. cyclotron. The data at 229 MeV covered the angles between 150 and 180° in the center-of-mass system; at 318, 337, and 390 MeV the angles between 70 and 180° were included. Scintillation counter hodoscopes were used in coincidence to detect both the pions and recoil protons. A small computer was used on-line to facilitate data handling and storage on magnetic tape. Phase shift analyses using this and other published data were made at the two lowest energies. Author (NSA)

N67-21559# California Univ., Livermore. Lawrence Radiation Lab.
MAGNETIC MIRROR FIELD CONTROL IN THE ASTRON EXPERIMENT
D. O. Kippenham 30 Sep. 1966 17 p ref Presented at the Symp. on Eng. Probl. of Controlled Thermonucl. Res., Gatlinburg, Tenn., 3–6 Oct. 1966 Submitted for publication
(Contract W-7405-ENG-48)
(UCRL-70035; CONF-661016-20) CFSTI: HC$3.00/MF$0.65

Sixty-five SCR controlled power supplies totaling 1.5 MW feed a long solenoid; and sixty-five transistorized pulse-width modulated power supplies, totaling 200 kW, feed two cantilevered solenoids inside the long solenoid. By appropriately controlling these power supplies, any magnetic field mirror geometry can be obtained. These mirror fields are used to capture and contain a 4-MeV beam in the Astron facility. By the use of five small common reference power supplies, a potentiometer per power supply, and a computer-type program board, the maximum depth and location of mirrors can be easily changed. Five console-mounted potentiometers control five magnetic mirrors in the solenoidal magnet system. The mirror control is linear and controllable from a maximum mirror depth to no mirror or level field. Author

N67-21560# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy.
QUARK MODEL OF BACKWARD SCATTERING
A. L. Lyubimov 1966 7 p refs
(JINR-E1-2941)

The consequences of the quark exchange model for backward scattering, concerned with the shape of the elastic backward scattering peak and antibaryon–baryon interaction, are considered. On the basis of the available experimental data on backward scattering an assumption is made about the additivity of two-body quark exchange amplitude. It is shown that considerations developed can be also applied to the exchange of different quarks in two-particle inelastic reactions. Author (NSA)

N67-21562# Commissariat a l'Energie Atomique, Fontenay-aux-Roses (France). Centre d'Etudes Nucleaires.

THE GENERATION OF HARMONICS OF THE ELECTRON CYCLOTRON HALF-FREQUENCY IN A DOUBLE-BEAM INTERACTION EXPERIMENT [GENERATION D'HARMONIQUES DE LA DEMI-FREQUENCE GIROMAGNETIQUE ELECTRONIQUE DANS UN SYSTEME "DOUBLE-FAISCEAU"]

Jack Olivain (Ph.D. Thesis—Paris Univ.) Sep. 1966 102 p refs In FRENCH Sponsored by EURATOM
(CEA-R-3075; EUR-3088.f)

The generation of harmonics of the electron cyclotron half-frequency in a double-beam interaction experiment was studied. A theoretical discussion is presented in which the transverse velocity distributions are represented by Dirac delta functions. The experimental measurements show the structure of the waves generated, for the fundamental mode [$\omega = (\omega/2)ce$], i.e. their azimuthal wave number, wave length, and radial profile of the oscillating potential, density and current. The quasi-electrostatic character of these waves was established from these results. Measurements were also made of the amplitudes and line widths of several harmonics as well as the growth rate of the first of them. Finally, a number of observations were made which show that nonlinear wave interactions play an important role in this system and which suggest an interpretation based on this mechanism for the generation of high-order harmonics. Author (NSA)

N67-21565# Kansas Univ., Lawrence. Nuclear Physics Lab.

DEUTERON INDUCED REACTIONS ON LIGHT ELEMENTS BELOW 3 MeV

G. U. Din 1 Sep. 1966 94 p refs
(Contract AT(11-1)-1120)
(COO-1120-47) CFSTI: HC $3.00/MF $0.65

Excitation functions and angular distributions for the elastic scattering of deuterons and alpha particles from ^{27}Al and angular distributions for the elastic scattering of deuterons from ^{29}Si were measured. Shapes of these functions are in agreement with Rutherford elastic scattering. Differential cross sections for the ^{23}Na (d,p)^{24}Na, $^{23}Na(d,\alpha)^{21}Ne$, $^{27}Al(d,p)^{28}Al$, $^{27}Al(d,\alpha^{25}Mg$, $^{29}Si(d,\alpha)^{27}Al$, $^{12}C(d,p)^{13}C$, $^{14}N(d,\alpha)^{12}C$, $^{18}O(d,p)^{17}O$, and $^{18}O(d,\alpha)^{14}N$ reactions to the ground states and some excited states of the residual nuclei were obtained for deutron bombarding energies between 1.5 and 3.0 MeV. These excitation functions show pronounced structure, to greater extent for the alpha groups than the proton groups. By using targets with thickness corresponding to an energy loss of about 2 keV at a bombarding energy of 2 MeV, a more detailed structure in the yield curves was observed. Angular distributions from 20° to 160° for the proton groups and from 30° to 160° for the alpha groups, taken in steps of 10°, were measured at several deuteron energies from 1.7 to 3.0 MeV. The shape of the angular distributions were found to be strongly energy dependent. Author (NSA)

N67-21569# Deutsches Elektronen-Synchrotron, Hamburg (West Germany).

SURVEY PRINCIPLES AND ADJUSTMENT OF EXPERIMENTS [VERMESSUNGSGRUNDLAGEN UND JUSTIERUNG VON EXPERIMENTEN]

Franz Loeffler Aug. 1966 40 p refs In GERMAN; ENGLISH summary
(DESY-66/28)

The basic parameters for the surveying of the synchrotron and experimental setups are given. The equipment of the surveying team and the methods applied in adjusting the experimental magnets are described. Author (NSA)

N67-21570# Brookhaven National Lab., Upton, N. Y. Health Physics Div.

RADIATION MONITORING AND DOSIMETRY WITH INTEGRATING PULSE DISCHARGE IONIZATION CHAMBER DETECTORS

C. Distenfeld and W. Bishop [1965] 18 p refs Presented at the Health Phys. Soc. Ann. Meeting, Los Angeles
(Contract AT(30-2)-GEN-16)
(BNL-9593; CONF-650616-8) CFSTI: HC $3.00/MF $0.65

Recently available integrating pulse discharge ionization chambers have been successfully used as detectors for portable dose integrators, environmental area monitors, and for a high energy pulsed accelerator monitoring system. The ion chamber physically consists of a pressure vessel, internally mounted gas discharge tube, anode support structure, and optional plastic inner lining. Chambers are available with either a Freon or Ethylene gas filling of about 10 atmospheres. Gamma sensitivity depends on the filler gas and liner, and is 0.25 and 0.6 mrad for Freon and Ethylene gas respectively. The gamma and neutron energy response characteristics, together with rate dependence effects, were investigated and are discussed. A transistorized, portable, dose integrator, with adjustable alarm level, was developed as an aid in controlling mission exposure to either gamma or mixed field radiation. The device can be set to alarm at any absorbed dose between 0.25 and 600 mrad in increments of 0.25 or 0.6 mrad. Cosmotron area monitoring consists of a sixteen channel system designed to alarm above about 1.2 mrem/hr. In each channel pulses are integrated on two registers, one resettable after appropriate data recording, and the other continuously running. The information presented on the Cosmotron area monitoring system is of an outline nature since the information will be published elsewhere. Author (NSA)

N67-21576# California Inst. of Tech., Pasadena.

NEW EXPERIMENTAL EVIDENCE ON REGGE POLES IN HIGH ENERGY SCATTERING

Steven C. Frautschi Sep. 1966 21 p refs Lecture Presented at the 2d Tokyo Summer Inst. of Theoret. Phys., Tokyo
(Contract AT(11-1)-68)
(CALT-68-106) CFSTI: HC $3.00/MF $0.65

The earliest high-energy experiments to be analyzed with Regge poles were measurements of total cross sections and diffraction peaks. The analysis involved many parameters because: many Regge poles could be exchanged in these processes; and the variation of Regge couplings with momentum transfer t could not be predicted even for a single exchange. Because of the large numbers of parameters, the fits obtained were not convincing. More recently, measurements of smaller high-energy cross sections, involving charge exchange, baryon exchange, and so forth have become available. Some of these provide cleaner tests of Regge pole theory, with fewer parameters. However, it was noticed that although the t dependence of couplings could not be predicted, the couplings sometimes predict zeros when α passes through integers or half integers in the Regge formula $d\sigma/dt(s,t) \sim f(t)s^{2\alpha(t)-2}$. The coupling zeros are classified into two types, signature zeros and nonsense zeros, and they are discussed. NSA

N67-21580# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics.

STUDY OF THE ROLE OF THREE-BODY FORCES IN THE TRITIUM PROBLEM USING A NON-LOCAL FACTORIZING POTENTIAL [ISSLEDOVANIE ROLI TREKHCHASTICHNYKH SIL V PROBLEME TRITIYA PRIMENENIEM NELOKAL'NOGO FAKTORIZUYUSHCHEGOSYA POTENTSIALA]

I. Sh. Vashakidze and G. A. Chilashvili 1966 12 p refs In RUSSIAN

(JINR-P4-2929)

The influence of three-body forces in the tritium problem is investigated using a nonlocal factorizing potential. It is shown that the experimental value of the tritium coupling energy can be obtained when three-body forces are considered to be of the repulsive nature. Author (NSA)

N67-21581# Oak Ridge National Lab., Tenn.

STUDY OF THE INTERACTIONS OF NEUTRONS WITH MATTER BY THE MONTE CARLO METHOD (AMERICAN PROGRAM 05R)

P. Paillere [1966] 29 p Transl. into ENGLISH from French

(ORNL-TR-1380) CFSTI: HC $3.00/MF $0.65

The operation of the 05R neutron transport program and posibilities for its application to neutron interactions with matter are described. The application to anisotropic elastic scattering and inelastic collisions is described. NSA

N67-21582# Texas Nuclear Corp., Austin.

A STUDY OF FLUORESCENT EXCITATION USING ISOTOPIC X-RAY EMISSION

Troy C. Martin, Kenneth R. Blake, Ira Lon Morgan, and C. Varren Parker, Jr. 30 Jun. 1966 66 p refs

(Contract AT(40-1)-3224)

(ORO-3224-6) CFSTI: HC $3.00/MF $0.65

The major factors involved in the utilization of the isotopic X-ray fluorescent analysis technique were investigated. These include matrix enhancement and absorption effects and beta-excited X-ray source efficiencies. The errors due to matrix effects in the energy region less than 5 keV have been found to be quite severe in several applications. The limitations imposed upon this technique in the low energy region due to relatively poor resolution of the gas spectrometer can be overcome somewhat by the use of X-ray filters. In addition, the use of a small beta-excited photon source permits the discrimination against X-rays from elements of higher atomic number in a given matrix. Preliminary results on the production of tritium-excited X-ray sources by the ion bombardment technique appear promising. Author (NSA)

N67-21584# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics.

THEORY OF SL(n,c) GROUP UNITARY REPRESENTATIONS

Doan Nhuong 1966 17 p refs In RUSSIAN

(JINR-P5-2977) CFSTI: HC $3.00/MF $0.65

All possible unitary irreducible representations of the main (non-degenerate and degenerate) series of group SL(n,c) are discovered in the language of the homogeneous functions. The connection is established between the representations studied and the Gelfand–Naimark's representations. Author (NSA)

N67-21586# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy.

ATTENUATION BY CONCRETE OF THE NEUTRON FLUX EMITTED AT 90° TO THE DIRECTION OF THE PRIMARY PROTON BEAM OF THE 10 GeV SYNCHROPHASOTRON [OSLABLENIE V BETONE POTOKA NEITRONOV, ISPUSKAEMYKH POD UGLOM 90°K NAPRAVLENIYU PERVICHNOGO PUCHKA PROTONOV SINKHROFAZOTRONA NA 10 GeV]

V. E. Aleinikov, V. N. Lebedev, V. Mantseva, and M. I. Salatskaya 1966 15 p refs In RUSSIAN

(JINR-P9-2933) CFSTI: HC $3.00/MF $0.65

Information is given about the attenuation in 3m-thick concrete layers of high and low energy neutrons which are generated by the Be or Cu target and emitted at 90° to the direction of the 10 GeV primary proton beam bombarding the target, i.e., in the geometry of annular accelerators. It is shown that these results can be applied to the accelerators with the energy up to some hundreds of GeV. Information is given also about the space–angular distributions of nucleons and π-mesons. Author (NSA)

N67-21588# General Electric Co., Schenectady, N. Y. Knolls Atomic Power Lab.

EVALUATION OF NEUTRON CROSS SECTIONS: CALCULATIONAL METHODS AND EVALUATED LIBRARIES

N. C. Francis, C. R. Lubitz, J. T. Reynolds, and E. L. Slaggie 1966 17 p refs Presented at the Conf. on Nucl. Data Microscopic Cross Sect. and other Data Basic for Reactors, Paris, 17–21 Oct. 1966

(Contract W-31-109-ENG-52)

(KAPL-P-3176; CONF-661014-6) CFSTI: HC $3.00/MF $0.65

Two theoretical models are outlined which are useful, in conjunction with experimental data, for providing neutron cross sections for reactor and shielding calculations. Several recommended sets of derived data are also given. NSA

N67-21589# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics.

DISPERSION SUM RULES IN THE STATIC MODEL [DISPERSIONNYE PRAVILA SUMM V STATICHESKOI MODELI]

V. G. Pisarenko 1966 9 p refs

(JINR-P2-2930) CFSTI: HC $3.00/MF $0.65

Dispersion sum rules are obtained for strong and electromagnetic nucleon interactions in the static model. The results are in good agreement with experiment at low energies. Author (NSA)

N67-21592# Joint Inst. for Nuclear Research, Dubna (USSR).

TWO-CENTER PROBLEM OF QUANTUM MECHANICS

L. I. Ponomarev 1966 27 p refs In RUSSIAN

(JINR-P2-3009) CFSTI: HC $3.00/MF $0.65

The results of numerical calculations of the two-center problem of quantum mechanics are given. Some interesting properties of the systems Z_1eZ_2 are observed for the $Z_1=1$ and $Z_2=3, \ldots, 8$ values. In particular the existence of the σ-term intersections in such a system, which were previously predicted by theory, is proved. The existence of stable states of molecular ions for large distances between the nuclei Z_1 and Z_2 is proved. Such a peculiar phenomenon, pseudointersections of terms, having no dynamical nature is found out. Possible applications of the results obtained are discussed. Author (NSA)

N67-21599# Illinois Univ., Urbana.

ELASTIC SCATTERING IN VELOCITY-SELECTED MOLECULAR BEAMS AT THERMAL ENERGIES

Jon B. Cross Oct. 1966 180 p refs

(Contract AT(11-1)-532)

(CALT-532-4) CFSTI: HC $3.00/MF $0.65

A molecular beam apparatus is described which was designed to obtain total and differential scattering cross sections using a velocity-selected beam and a universal mass spectrometer detector.

The product of the Lennard–Jones parameters (ϵ-σ) was determined from total scattering measurements for the following systems: N_2-N_2, 4.9×10^{-22} erg-cm ±15%; D_2-Kr, 4.1×10^{-22} erg-cm ±10%; H_2-Kr, 4.3×10^{-22} erg-cm ±15%. Author (NSA)

N67-21603# University of Southern Calif., Los Angeles. Dept. of Physics.

NUCLEAR PHYSICS RESEARCH LABORATORY Annual Progress Report, 1 Oct. 1965–30 Sep. 1966

Oct. 1966 87 p refs

(Contract AT(04-3)-136)

(USC-136-114) CFSTI: HC $3.00/MF $0.65

A DWAB analysis of the deuteron angular distribution from the reaction ^{3}He(p,d)2p was performed, and pickup reactions on ^{8}Li were studied. Angular distributions and spectra from the (p,d) (p,He-3), (p,He-4), and (p,t) reactions on ^{6}Li were measured. Similar measurements were made for the (p,He-3) and (p,He-4) reactions on ^{7}Li, and a plane-wave Born approximation was used to fit the data. A DWBA analysis of the ^{7}Li(p,d) reaction was also performed. The total reaction cross section of ^{9}Be was measured for proton energies of 18 to 28 MeV, and angular distributions for the reactions ^{9}Be(p,p), ^{9}Be(p,p'), and ^{9}Be(p,d) ^{8}Be were obtained. The effect of shell closure at Z = 28 was investigated by measuring the reaction cross sections of Co, Cu, Fe, Ni, and Zn for 17-MeV protons. An optical-model analysis of proton elastic scattering by ^{9}Be was also performed. The elastic and inelastic scattering of 30-MeV protons by ^{24}Mg and ^{26}Mg was investigated; the elastic scattering data were analyzed using a diffuse-surface optical model. The elastic scattering of 28-MeV protons by nuclei around Z = 28 was investigated by measuring the angular distributions of protons elastically scattered by Co, Fe, Ni, and Zn; a good fit to the angular distribution for Zn was obtained using a diffuse-surface optical model. Cross sections for the (p,p), (p,d), and (p,t) reactions on ^{93}Nb at 30 MeV were also measured, and measurements were made of proton energy losses in a variety of materials. Variational calculations, using various types of central two-body forces compatible with N–N scattering phase shifts, were used to study the possibility of low-lying virtual excited states in the three-nucleon system. The effect of the long-range part of nuclear forces in the theory of nuclear matter was also studied, and the algebra of current components was used to study the magnetic moment of the $3/2^+$ decuplet and the decay modes of the hyperon (Ω^-). In addition, it was shown that the Dirac equation results from the quantization of a classical theory in which the electron is regarded as a point charge that always moves with the speed of light. NSA

N67-21605# California Univ., Berkeley. Lawrence Radiation Lab.

A STUDY OF RESONANCE PRODUCTION AND DECAY AND ELASTIC SCATTERING IN π^-p TWO-PRONG INTERACTIONS, 2.05 TO 3.22 GeV/c

Laurence David Jacobs (Ph.D. Thesis) 16 Aug. 1966 199 p refs

(Contract W-7405-ENG-48)

(UCRL-16877) CFSTI: HC $3.00/MF $0.65

An analysis of 45,000 π^-p interactions in the Alvarez 72-inch hydrogen bubble chamber resulting in two charged particles is presented. The reactions $\pi^-p\rightarrow n\pi^+\pi^-$ and $\pi^-p\rightarrow p\pi^0\pi^-$ and elastic scattering were studied at 2.05, 2.17, 2.36, 2.60, 2.86, and 3.22 GeV/c. The three-body interactions were found to be dominated by production of the ρ meson. Nucleon resonances, although present, are not important. The f^0 is seen at the three higher energies. The OPE model, modified by absorption, was used to calculate and fit the production and decay angular distributions of the ρ and to estimate the s-wave contribution to $\pi\pi$ scattering. On the basis of the model and the observed (F–B)/(F+B) assymmetry in the $\pi^+\pi^-$ state, good agreement with the experimental data in the ρ region is found, if δ_0^0 is allowed to increase slowly through $\pi/2$. A resonant isoscalar s-wave amplitude was not required. The diffraction peak in π^-p elastic scattering was fitted to an exponential form and it was found that between 2.0 and 2.5 GeV/c the exponential slope varies. This behavior is linked to the presence of resonances in the s channel. The fast decrease of the secondary peak is linked to the exchange of the P' Regge trajectory in the t channel. Evidence is shown for production of the A_2^- in $\pi^-p\rightarrow\pi^-p$ + missing mass. Author (NSA)

N67-21608# Johns Hopkins Univ., Baltimore, Md.

NUCLEAR REACTIONS IN LIGHT NUCLEI AND MOESSBAUER STUDIES

Yung Keun Lee et al Nov. 1966 237 p refs

(Contract AT(30-1)-2028)

(NYO-2028-1) CFSTI: HC $3.00/MF $0.65

The effect of Coulomb excitation on Moessbauer spectra of Fe^{57} in Fe and F_2O_3 was investigated; and Moessbauer experiments were performed on Dy^{164}, Er^{168}, Gd^{155}, Gd^{158}, Gd^{158}, Gd^{160}, and Yb^{174} using Coulomb excitation. Ratios of quadrupole moments were obtained for the even–even isotopes of Gd. Well-resolved magnetic hyperfine structure was observed in Dy^{164} and Er^{168}, and estimates of the magnetic energy splitting were obtained. Unresolved quadrupole structure was observed in Yb^{174}, and the quadrupole interaction energy was determined. Moessbauer levels were observed in Yb^{172}, Yb^{174}, and Yb^{176} following the population of the first excited states by Coulomb excitation; the quadrupole energy splittings and relative quadrupole moments were determined for each isotope. The electric field gradient at the nucleus and the asymmetry parameter for Yb in Yb_2O_3 were obtained from Coulomb excitation cross-section data. In addition, the magnetic moment and spin of the second excited state of Fe^{57} was determined by observing the Moessbauer effect of the 136.4-keV decay. Moessbauer measurements on Gd^{156} gave a lower limit for the lifetime of the first excited state and indicated a spin of 1/2 for the second excited state as well as a quadrupole splitting of 9.3×10^{-7} eV for the ground state. Hyperfine interaction energies of Yb^{170} in Yb_2O_3 and $YbCl_3\cdot6H_2O$ were also measured using Moessbauer techniques. Equipment was developed for Moessbauer studies at high and low temperatures, and experiment was prepared for the observation of polarization from the reaction $Fe^{56}(d,p)Fe^{57}$, using the Moessbauer effect. The polarization of the B^{12} recoil nuclei from the reaction $B^{11}(d,p)B^{12}$ was investigated as a function of deuteron energy, recoil angle, and the types of recoil stopping material-angular distributions and excitation functions for the reaction $F^{19}(d,n)Ne^{20}$ were measured in the energy range from 0.9 to 2.7 MeV; the angular distributions were analyzed in terms of a dual-mode plane-wave theory that incorporates exchange and interference terms. Li-drifted Ge gamma detectors were fabricated and tested, and a magnetic spectrometer was developed for Moessbauer studies. A prototype of a large-area neutron detector using slabs of scintillator was also constructed. NSA

N67-21609# Edgerton, Germeshausen and Grier, Inc., Santa Barbara, Calif.

NUCLEAR STUDIES OF THE COMPTON DIODE, FISCAL YEAR 1966

J. Stevens and J. F. Artuso Nov. 1966 82 p refs Prepared for Lawrence Radiation Lab., Calif. Univ., Livermore

(Contract W-7405-ENG-48)

(EGG-1183-2110; S-349-R; UCRL-13251) CFSTI: HC $3.00/MF $0.65

A spherical electrostatic spectrometer was used to measure electron currents emitted from metal plates bombarded with gamma rays from ^{60}Co and ^{137}Cs sources. Measurements of the current leaving the target, as a function of the retarding field, yield energy spectra in the range of approximately 0 to 1500 eV. Theoretical energy resolution of this spectrometer is 1.7 percent. Comparisons between theory and experiment are made for both energy spectra and total yield. Calculations are also discussed of the angular and energy distributions of the high-energy electrons knocked out of

the plate by the gamma rays. The present theory which calculated quantum efficiencies at 0.662 and 1.25 MeV correctly, calculates energy and angular distributions incorrectly. The expression currently being used to calculate the transmission of electrons is analyzed and shown to be somewhat in error. The need to consider Moller scattering is pointed out, and equations for determining the effect of secondary electrons on response function are presented. Some results of quantum efficiency calculations are listed and the need for experimental data at additional energies is pointed out. Author (NSA)

N67-21610# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics.
ON THE CURRENT DIVERGENCES
L. Enkovski, V. V. Kukhtin, I. Montvai, and Nguyen Van Hieu
1966 6 p refs
(JINR-E2-3039)

In the framework of the quark model the divergences of axial and vector hadronic currents are considered taking into account, in the first order, the electromagnetic and weak interactions (semileptonic and nonleptonic). On the basis of these relations for current divergence many consequences of current algebra dealing with the electromagnetic and weak interactions can be derived. Author (NSA)

N67-21613# Vanderbilt Univ., Nashville, Tenn.
THE AUGER, INTERNAL CONVERSION AND GAMMA-RAY SPECTRA FROM THE DECAY OF Pa^{233} AND AN INVESTIGATION OF THE EFFECT OF PHOTOELECTRON SCATTERING ON THE IEC METHOD
Michael Joseph Zender (Ph.D. Thesis) Aug. 1966 147 p refs
(Contract AT(40-1)-1087)
(TID-23362) CFSTI: HC$3.00/MF$0.65

The results of an investigation of the Auger, internal-conversion, Coster–Kronig, and gamma spectra of U^{233} from the decay of Pa^{233} are presented, and a decay scheme is proposed for Pa^{233}. The effects of photoelectron scattering on the f factor used in the internal–external method for determining conversion coefficients was also investigated. NSA

N67-21616# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics.
COVARIANT STRUCTURE OF CAUSAL S-MATRIX ELEMENTS FOR AN ARBITRARY SPIN, II [KOVARIANTNAYA STRUKTURA ELEMENTOV PRICHINNOI S-MATRITSY DLYA PROIZVOL'NOGO SPINA (II)]
L. Sh. Khodzhaev 1966 10 p refs In RUSSIAN
(JINR-P2-3045)

In the framework of the Bogoliubov's asymptotic causal S-matrix theory a covariant tensor generalized M-functional is determined which transforms by tensor product of nonunitary finite noncompact representations of the universal i SL (2,C) group of the P^+ Poincaré group. Author (NSA)

N67-21618# General Dynamics Corp., San Diego, Calif. John Jay Hopkins Lab. for Pure and Applied Science.
INTEGRAL NEUTRON THERMALIZATION Quarterly Progress Report, Period Ending 30 Jun. 1966
H. Antunez, J. R. Beyster, G. Borgonovi, G. Carriveau, D. H. Houston et al 22 Jul. 1966 94 p refs
(Contract AT(04-3)-167)
(GA-7283) CFSTI: HC$3.00/MF$0.65

Progress is reported on improved utilization of the GASKET–FLANGE Codes. The FLANGE Code calculates neutron scattering kernels from scattering law input. The GASKET Code is used to generate scattering laws (FLANGE input) to correct previous errors or to incorporate improved dynamical models for various moderators. Studies were made of multiple neutron scattering in H_2O. This work is intended to make the observed and caluclated scattering laws self-consistent. Scattering laws for D_2O and BeO were generated by means of GASKET. The phonon spectrum of BeO was calculated and was used to generate a scattering kernel. Thermal neutron spectra in diphenyl and at a diphenyl-D_2O interface were measured. The leakage neutron spectrum from the Accelerator Pulsed Fast Assembly (APFA) was measured by the pulsed-source, time-of-flight technique and was compared with Sn transport calculations. A large-volume plastic scintillator is being constructed for use in neutron detection via (n,γ) capture reactions. The specific purpose of the detector is the measurement of neutron flux with high efficiency and near-zero background at neutron energies ranging from 100 eV up to 15 MeV. A description is given of a 200-meter neutron flight path. NSA

N67-21619# Atomic Energy of Canada, Ltd., Chalk River (Ontario).
PHYSICS DIVISION Progress Report, 1 Apr.–30 Jun. 1966
L. G. Elliott et al 30 Jun. 1966 75 p refs
(AECL-2611; PR-P-70) Available from Atomic Energy of Canada, Ltd., Chalk River: $2.00

Progress is reported on studies of anisotropy of fission fragments in the U^{235}(d,pf) and Pu^{239}(d,pf) reactions; gamma ray angular correlation measurements on levels in Si^{29}; Ne^{20} levels populated by the $He^4(^{16}O,\gamma)$ reaction; lifetimes of levels in Mg^{24}; gamma-ray branching ratios of low-lying levels of Si^{29}; gamma transition energies in I^{125} and Pr^{143}; measurement of the 2200 m/sec neutron cross section for deuterium relative to that of Co^{59}; measurement of the half life of H^3; inelastic neutron scattering from phonons in potassium at 299°K; measurements of the [ξξξ] L branch of the phonon spectrum in the alloy $Nb_{0.25}-Mo_{0.75}$ at room temperature using coherent one-phonon scattering of slow neutrons; crystal dynamics of tin telluride; magnetic excitations in CoF_2 crystals below a frequency of 5×10^{12} cps at 90 and 5°K by means of inelastic neutron scattering; gamma energies from the $Cr^{50}(n,\gamma)Cr^{51}$ reaction for thermal neutrons; and effects of space and image charges in a bunched ion beam. NSA

N67-21625# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics.
SYMMETRY RELATIONS FOR THE ELECTROMAGNETIC PARTICLE POLARIZABILITIES [SOOTNOSHENIYA SIMMETRII DLYA ELEKTROMAGNITNYKH POLYARIZUEMOSTEI CHASTITS]
V. S. Barashenkov, R. P. Zaikov, and E. Kapustsik 1966 5 p refs In RUSSIAN
(JINR-P-2894)

It is considered what relations between electric and magnetic polarizabilities of the baryons and mesons can be obtained in the SU_3 and SU_6 groups. In particular, it is found that two independent experiments are necessary for the determination of electric proton and neutron polarizabilities. The π^0-meson polarizabilities are expressed in terms of the matrix elements of the two-photon decays of ϕ, ω, η-resonons; therefore they can be experimentally investigated. The experimental situation is briefly discussed. Author (NSA)

N67-21627# Atomic Weapons Research Establishment, Aldermaston (England).
ION BUNCHING SYSTEM FOR THE 6 MV VAN DE GRAAFF ACCELERATOR
J. H. Anderson Oct. 1966 43 p refs
(AWRE-O-53/66)

A radio frequency chopping and a klystron type of bunching system is described for the generation of short-duration ion bursts

in which the bunching and chopping equipment is incorporated in the top terminal of a 6 MV Van de Graaff accelerator. A method for setting up and monitoring the beam burst width is also described. Test bench measurements on the bunching system indicate ion burst durations for H_1^+, H_2^+, H_3^+ beams of less than 1 ns at half height with peak current gain factors of greater than 4:1. Electronic and time-of-flight measurements carried out after installation indicate the beam burst duration to be less than 1.5 ns at target for protons and deutrons. A mean pulsed beam current of 10 μA on target compares with 1 μA previously obtainable using the top terminal flapping method for pulsing. Author (NSA)

N67-21630# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics.

MANY PARTICLE MECHANISM OF INTERACTION OF COSMIC RAYS WITH ATOMIC NUCLEI [MNOGOCHASTICHNYI MEKHANIZM VZAIMODEISTVIYA KOSMICHESKOGO IZLUCHENIYA S ATOMNYMI YADRAMI]

I. Z. Artykov, V. S. Barashenkov, and S. M. Eliseev 1966 8 p refs In RUSSIAN
(JINR-P2-3005)

Interactions of nucleons with photoemulsion nuclei are calculated for the energies of 6 to 1000 GeV. Many-particle cascade interactions inside the nuclei are taken into account. The results of calculations are compared with the experimental data. Author (NSA)

N67-21633# Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.

STUDY OF THE $\bar{K}\pi$ SYSTEM IN THE 3 BODIES FINAL STATES, PRODUCED BY 3 GeV/c K^-p INTERACTIONS [ETUDE DU SYSTEME $\bar{K}\pi$ DANS LES ETATS FINALS A 3 CORPS PRODUITS PAR LES INTERACTIONS K^-p A 3 GeV/c]

Alain Verglas (Ph.D. thesis) 1966 78 p refs In FRENCH
(CEA-R-3032)

The $K^-P \rightarrow K^*$ (891) N reaction is a good example of a quasi-two-body phenomenon, exhibiting the characteristics of periperism. The predictions of the one meson exchange, and absorption models are compared with the experimental results. Conclusions are drawn concerning the production mechanism of the $KP \rightarrow K^*$ N reaction, as well as on the validity of the models. Finally, the K^* (1400) resonance is studied and its isospin determined. Author (NSA)

N67-21634# Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.

THEORETICAL AND EXPERIMENTAL STUDY OF IONS FOCUSING SYSTEMS IN ORDER TO IMPROVE THE IONS BEAM BRIGHTNESS BY SUPPRESSING ABERRATION CAUSES [ETUDE THEORIQUE ET EXPERIMENTALE DE LA FOCALISATION DES IONS AFIN D'AMELIORER LA BRILLANCE DU FAISCEAU IONIQUE PAR SUPPRESSION DES CAUSES D'ABERRATIONS]

Jean Faure (Ph.D. thesis) 1966 73 p refs In FRENCH
(CEA-R-3002)

It is shown that a beam brightness can be improved by an order of magnitude when the sources of aberrations are suppressed in the anode region source, as well as in the extraction region and in the electrostatic focusing system. A calculation was first set up to determine a simple focusing system. The aberration rstio due to this focusing system is smaller than 10 to 15 per cent. The experimental study was developed by using an ion source and its extraction system capable of producing an aberration free beam at an energy of 20 keV and an accelerating unit up to 190 keV that confirms that the qualities of a 35 mA beam produced by the said ion source are not spoiled when the beam goes through the focusing and accelerating system that was designed to be aberration free. Author (NSA)

N67-21636# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics.

UNITARY STATISTICAL MODEL OF MULTIPLE PARTICLE PRODUCTION [UNITARNAYA STATISTICHESKAYA MODEL' MNOZHESTVENNOGO ROZHDENIYA CHASTITS]

V. S. Barashenkov, G. M. Zinov'ev, and V. M. Mal'tsev 1966 6 p refs In RUSSIAN
(JINR-P2-3007)

A statistical SU_3 breaking symmetry model is discussed. The results of calculations agree well with experiment. Disagreement is seen only for interactions with a small number of particles produced. Author (NSA)

N67-21641# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems.

MEASUREMENT OF THE PROBABILITY RATIO FOR $\pi^-d \rightarrow nn$ AND $\pi^-d \rightarrow nn\gamma$ REACTIONS [IZMERENIE OTNOSHENIYA VEROYATNOSTEI REAKTSII $\pi^-d \rightarrow nn$ I $\pi^-d \rightarrow nn\gamma$]

M. A. Musin, V. I. Petrukhin, and Yu. D. Prokoshkin 1966 14 p refs In RUSSIAN Submitted for publication
(JINR-P1-2996)

The probability ratio for the reactions $S = W(\pi^-d \rightarrow nn)/W(\pi^-d \rightarrow nn\gamma)$, induced by the stopping of negative mesons in deuterium, is determined by comparing the γ quanta yields from hydrogen and deuterium gas target. The value obtained ($S = 2.94 \pm 0.15$) is in disagreement with that calculated by data on π-meson production in collisions of nucleons and γ quanta with nucleons (1.6 ± 0.4). Author (NSA)

N67-21642# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy.

NEW METHOD FOR MEASURING THE EFFECTIVE MASS IN THE DECAYS $x \rightarrow \gamma + \gamma$

M. A. Azimov, A. S. Belousov, I. V. Chuvilo, R. Firkowski, M. N. Khachaturyan et al 1966 16 p refs
(JINR-E13-2971)

A new method is described for effective mass measurement in the decays: $x \rightarrow \gamma + \gamma$ etc. with a two-channel system of jointly operating spark chambers and Cherenkov gamma spectrometer. The system is calibrated for the decays: $\pi^0 \rightarrow \gamma + \gamma$. The $\Delta M/M$ resolution was obtained to be ±10%. Author (NSA)

N67-21643# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems.

ELASTIC N-N-SCATTERING AMPLITUDES [AMPLITUDY UPRUGOGO RASSEYANIYA NUKLONOV NUKLONAMI]

B. M. Golovin and A. M. Rozanova 1966 46 p refs In RUSSIAN Submitted for publication
(JINR-P-2861)

On the basis of the previously published data on the phase shift analysis, the elastic N–N scattering amplitudes are calculated for energies in the range 23 to 630 MeV. Some peculiarities of the amplitudes are mentioned. The values obtained for spinless terms are compared with the predictions based on dispersion relations. Author (NSA)

N67-21644# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics.

SU(3): BREAKING AS CONSEQUENCE OF INTERACTION OF HADRON CURRENTS

I. Montvai 1966 8 p refs Submitted for publication
(JINR-E2-3071)

Supposing the medium-strong interaction Hamiltonian to be bilinear expression of vector and axial-vector currents, sum

rules concerning strong decays and mass splitting are investigated. The derivation of sum rules is based on divergence conditions. Author (NSA)

N67-21645# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics.
CURRENT-FIELD EQUAL-TIME COMMUTATION RELATIONS
I. Byalynitskii-Birulya and Nguyen Van Hieu 1966 6 p refs Submitted for publication
(JINR-E2-3006)

The U(6) ⊗ U(6) group is constructed on the basis of the current algebra without intrinsic contradictions. In contrast to the method of Gel-Mann et al., the SU(6) group is here a transformation group of the field operators. Author (NSA)

N67-21655# Deutsches Elektronen-Synchrotron, Hamburg (West Germany).
ELASTIC ELECTRON–PROTON SCATTERING AT MOMENTUM TRANSFERS UP TO 110 FERMI^{-2}
H. J. Behrend, F. W. Brasse, J. Engler, S. Galster (Kernforschungszentrum), E. Ganssauge (Marburg Univ.) et al Oct. 1966 44 p refs
(DESY-66/27)

Elastic electron–proton cross sections were measured at various angles between 32 and 130°, and with momentum transfers of q^2=39, 60, 80, and 110 f^{-2}. Two single quadrupole spectrometers, movable around a common liquid hydrogen target, were used to analyze the momentum of the scattered electrons. Cherenkov and shower counters discriminated against pion and low energy background. As a cross section reference, recoil protons from elastic scattering at q^2=10 f^{-2} were used, with a quantameter serving as a intermediate monitor. The data are consistent with the Rosenbluth formula, giving real form factors G_E and G_M. Both continue to decrease with increasing momentum transfer, but somewhat faster than indicated by previous measurements. Author (NSA)

N67-21656# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics.
VECTOR MESON PRODUCTION AND THE [SU(3) × SU(3)]$_{coll}$ SYMMETRY [ROZHDENIE VEKTORNOGO MEZONA I SIMMETRIYA]
P. Winternitz and A. L. Zubarev 1966 9 p refs In RUSSIAN Submitted for publication
(JINR-P2-2967)

The collinear production of a vector meson is considered in the scattering of pseudoscalar mesons on baryons. Relations between the experimental quantities, following from the symmetry [SU(3)×SU(3)]$_{coll}$ are obtained. Author (NSA)

N67-21658# Princeton-Pennsylvania Accelerator, Princeton, N. J.
ELASTIC SCATTERING OF K$^+$ MESONS BY Be^9 AT 960 MeV/c
Frederick V. Murphy, Jr. Sep. 1966 108 p refs
(Contract AT(30-1)-2137)
(PPAD-601F) CFSTI: HC $3.00/MF $0.65

A velocity-selecting Cherenkov counter in a 950 MeV/c 13° beam at the Princeton–Pennsylvania Accelerator identified K^+ mesons, which then interacted in Be^9 targets in a thin plate spark chamber. Photographs of the scattering were automatically scanned and digitized by a flying-spot cathode ray tube controlled by a PDP-1 computer. The spark coordinates were used to identify and reconstruct 4,000 nuclear elastic scatterings. The differential cross section was fit by a nuclear optical model, assuming a modified Gaussian shape, with a complex repulsive potential U=(+5±5) MeV−i (28±3) MeV. The volume integral of this potential agrees well with a prediction from the K^+–nucleon forward scattering amplitudes computed from the T=1 s-wave and p-wave phase shifts known at this momentum and from the T=0 s-wave and p-wave phase shifts extrapolated from measurements up to 812 MeV/c. This suggests that the T=0 and T=1 S=+1 K–nucleon scattering is still dominated by s-waves and p-waves at 950 MeV/c. Author (NSA)

N67-21661# Brandeis Univ., Waltham, Mass. Dept. of Physics
RESEARCH IN ELEMENTARY PARTICLE PHYSICS Technical Progress Report, 1 Sep. 1965–15 Jun. 1966
Sanford E. Wolf 15 Jun. 1966 13 p refs
(Contract AT(30-1)-3178)
(NYO-3178-3) CFSTI: HC $3.00/MF $0.65

Several experiments on K^- nucleon interactions in the range of 1600 to 1700 MeV are reported. These are $K^- + p \rightarrow \Lambda + \pi^0$, $K^- + n \rightarrow \Lambda^0 + \pi^-$, $K^- + n \rightarrow \Lambda^0 + \pi^- + \pi^0$, $K^- + n \rightarrow \Delta^0 + \pi^- + \pi^+$, $K^- + n \rightarrow \Sigma^+ + \pi^- + \pi^-$, $K^- + D \rightarrow \Lambda^0 + p + \pi^-$, $K^- + D \rightarrow \Lambda^0 + p + \pi^- + \pi^0$, and $K^- + D \rightarrow \Delta^0 + n + \pi^- + \pi^+$. NSA

N67-21663# Oak Ridge National Lab., Tenn.
OPTICAL MODEL AND INELASTIC SCATTERING
G. R. Satchler [1966] 28 p refs Presented at the Intern. Conf. on Nucl. Phys., Gatlinburg, Tenn., 12–17 Sep. 1966
(Contract W-7405-ENG-26)
(ORNL-P-2570; CONF-660906-43) CFSTI: HC $3.00/MF $0.65

The situation on experimental data for use in optical-model analyses of elastic and inelastic scattering is summarized. It is concluded that microscopic analysis of inelastic scattering promises to be a powerful spectroscopic tool for checking nuclear wavefunctions. NSA

N67-21665# Los Alamos Scientific Lab., N. Mex.
NEUTRON RESONANCES AND REACTIVITY
Carroll B. Mills 24 Oct. 1966 72 p refs
(Contract W-7405-ENG-36)
(LA-3560-MS) CFSTI: HC $3.00/MF $0.65

A simple and consistent treatment of neutron cross sections is presented for use in reactor physics. A review is given of the elementary isolated resonance equations, and two codes are presented for the resolved and unresolved resonance regions. The resolved resonances are integrated over the Boltzmann velocity distribution function for absorber atoms at a sufficient number of neutron energy points so that the Doppler and moderator scattering effects can be computed accurately and rapidly. Resonance interference and scattering effects are explicit. Further, weighting functions specific to narrow and wide resonances, with and without a reactor neutron slowing down density weight, are used, and the resulting values are punched on standard cross-section data cards for reactor oriented calculations. The unresolved resonances are treated in very much the same way, but with an average of resonance neutron reduced width and position selected by Monte Carlo techniques. The results are presented for a few perturbation-theory calculations of material reactivity (reactor center and a radial distribution) for elements of interest to the LASL N-Division. Both Argonne National Laboratory (ZPR-III) and Los Alamos (Phoebus 1 and 2) flux adjoints are used for cross-section evaluation, and in one illustrative case these resulted in a significant improvement. Results are given of an application of summary methods for neutron cross-section averaging from basic data. The results presented are preliminary, but indicate that this area of activity should be very fruitful, and should provide a great simplification of specific cross-section tabulation in the field of reactor physics. Author (NSA)

N67-21668# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics.
NOTE ON THE PARASTATISTICS
A. B. Govorkov 1966 6 p refs Submitted for publication
(JINR-E2-3003)

It is shown in terms of the Wightman functions for the Green ansatz components that parafields are canonical (Fermi- or Bose-) fields with a certain degree of freedom but written in another form. The hypothesis of paraquarks and its relation to the assumption about the existence of three quark triplets are discussed.
Author (NSA)

N67-21669# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy.
OPTICAL MODEL OF HIGH ENERGY ELASTIC SCATTERING AT 180° [OPTICHESKAYA MODEL UPRUGOGO RASSEYANIYA NA UGOL 180° PRI VYSOKIKH ENERGIYAKH]
V. S. Stavinskii 1966 5 p refs In RUSSIAN
(JINR-P2-3018)

An analysis is made of the experimental data on high energy elastic scattering of particles at large angles from the optical point of view. The parameters of the interaction are obtained.
Author (NSA)

N67-21670# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics.
ON A DERIVATION OF CHEW-LOW EQUATIONS AND THE ORIGIN OF CUTOFF FUNCTION IN STATIC MODELS [O VYVODE URAVNENII CHU-LOU I PROISKHOZHDENII FUNKTSII OBREZANIYA V STATICHESKIKH MODELYAKH]
V. A. Meshcheryakov 1966 15 p refs In RUSSIAN Submitted for publication
(JINR-P2-3054)

A method is suggested to derive Chew–Low equations from the Mandelstam representation. The meaning of the cutoff function in static models is cleared up. It takes into account the partial wave cut from the third channel. It is shown that this function can also be considered as an account of inelastic processes in two first channels.
Author (NSA)

N67-21671# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics.
QUANTUM NUMBERS IN THE LITTLE GROUPS OF THE POINCARE GROUP
I. Lukach, Ya. A. Smorodinskii, and P. Winternitz 1966 15 p refs Submitted for publication
(JINR-E2-2982)

Integrals of motion and quantum numbers in the groups O(3), O(2,1) and E_2 are considered. It is shown that an integral of motion, expressed as a homogeneous hermitian operator, quadratical in the generators of the corresponding group, corresponds to each coordinate system in which the Laplace equation separates. Any operator of the mentioned type is equivalent to one of the discussed polynomials.
Author (NSA)

N67-21672# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems.
SHOWERS IN LEAD PRODUCED BY 0.1 TO 1 GeV γ-QUANTA [LIVNI V SVINTSE, OBRAZOVANNYE γ-KVANTAMI S ENERGIEI OT 0.1 DO 1 GeV]
O. A. Zaimidoroga, Yu. D. Prokoshkin, and V. M. Tsupko-Sitnikov 1966 13 p refs In RUSSIAN Submitted for publication
(JINR-P1-2990)

The characteristics of the showers, produced in lead by γ-quants with the energy 0.1; 0.2; 0.3; 0.5, and 1 GeV, are determined on the basis of the experimental data on distributions according to the electron number in showers, generated by electrons in lead.
Author (NSA)

N67-21673# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy.
STRUCTURE IN ELASTIC BACKWARD π^+p-SCATTERING [STRUKTURA V UPRUGOM π^+p-RASSEYANII NAZAD]
A. S. Vovenko, B. N. Gus'kov, T. Dobrovol'skii, M. F. Likhachev, A. L. Lyubimov et al 1966 9 p refs In RUSSIAN Submitted for publication
(JINR-P1-3008)

The energy dependence of the differential cross section of elastic π^+p-scattering at about 174° in the cms is measured in the range of 2.06 to 4.70 GeV/c. Maxima of this cross section occur at the energies of formation of baryon resonance Δ (2420) and Δ (2840). This structure is used to determine the parity of these isobars.
Author (NSA)

N67-21674# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics.
STATISTICAL THEORY WITH BREAKING UNITARY SYMMETRY FOR ANNIHILATION PROCESSES [STATISTICHESKAYA UNITARNO-SIMMETRICHNAYA TEORIYA ANNIGILYATSIONNYKH PROTSESSOV]
V. S. Barashenkov, G. M. Zinov'ev, and V. M. Mal'tsev 1966 8 p refs In RUSSIAN Submitted for publication
(JINR-P2-3001)

A statistical model with breaking unitary symmetry is proposed. The results of calculations, performed for the pβ-annihilation case, are close to the experimental ones. An essential disagreement is seen only for the relative probabilities of channels with a small number of particles.
Author (NSA)

N67-21678# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems.
INCREASING THE DISCHARGE DURATION IN A SPARK CHAMBER UP TO 10 TO 100 μSEC [UVELICHENIE DLITEL'NOSTI RAZRYADA V ISKROVOI KAMERE DO 10–100 MSEC]
Yu. K. Akimov, V. N. Protsenko, V. I. Rykalin, A. A. Tyapkin, and V. P. Khromov 1966 11 p refs In RUSSIAN
(JINR-P13-3064)

A method to increase the discharge duration in a spark chamber for the time up to 10 to 100 μsec is described and investigation results of such discharge conduct in time are given.
Author (NSA)

N67-21679# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy.
INELASTIC π^-p INTERACTIONS AT ENERGY 7.5 GeV. PART III: FOUR-PRONG EVENTS WITH NEUTRONS [NEUPRUGIE π^-p VZAIMODEISTVIYA PRI ENERGII 7.5 GeV. CHAST III: 4-LUCHEVYE SOBYTIYA S NEITRONAMI]

E. Balya, O. Balya, V. A. Belyakov, E. N. Kladnitskaya, E. S. Kuznetsova et al 1966 18 p refs In RUSSIAN
(JINR-P1-2963)

524 events of the reaction $\pi^- p \rightarrow n\pi^+\pi^+\pi^-\pi^- m\pi^0$ ($m \geq 0$) at 7.5 GeV were analyzed. The cross section is found to be $\sigma = 3.7 \pm 0.3$ mb. The correlation is established between transverse and longitudinal particle momenta in the cms. Production of a ρ^0– meson and a $N^*_{3,3}$-isobar is observed. There is some indication to the production of A_1 and A_2 mesons too. Author (NSA)

N67-21680# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy.
INVESTIGATION OF THE REACTION $\pi^+ + p \rightarrow \pi^+ p\pi^0$ MESON MOMENTUM OF 2.34 GeV/c [IZUCHENIE REAKTSII $\pi^+ + p \rightarrow \pi^+ p\pi^0$ PRI IMPUL'SE π^+ MEZONOV 2.34 GeV/c]
S. Angelov, I. M. Gramenitskii, A. I. Zlateva, Kh. M. Kenazirski, P. P. Keratsev et al 1966 24 p refs In RUSSIAN
(JINR-P1-2997)

Characteristics of the reaction $\pi^+ + p \rightarrow \pi^+ p\pi^0$ at the primary π^+-meson momentum of 2.34 GeV/c were investigated on the photographs of a 40 cm hydrogen bubble chamber. Production of ρ^+-mesons and $N^*_{3/2,3/2}$ isobars was studied. The differential cross section $d\sigma_\rho/dt$ and the matrix for ρ^+-mesons and isobar were obtained. The experimental data are compared with the results of calculation according to the absorption model. Author (NSA)

N67-21683# Commissariat a l'Energie Atomique, Saclay (France).
CONTRIBUTION TO THE PRECISE MEASUREMENT OF THE ACTIVITY OF NON-POINT SOURCES BY THE USE OF THE WELL-TYPE IONIZATION CHAMBER
Jean Dalmazzone Oct. 1966 150 p refs In FRENCH
(CEA-R-3071) CFSTI: HC $3.00/MF $0.65

The well-type ionization chamber is commonly used to measure the activity of solid, liquid or gaseous β, γ and β–γ sources (the first by making use of Bremsstrahlung) over a wide activity range (from a few μCi to several Ci). The volume of these sources can be appreciable owing to the existence of large zones of equal sensitivity verified by means of a Ra point source. However the response of the chamber is closely dependent on the geometry of the source, in particular its volume, for weakly penetrating radiations such as β's, Bremsstrahlung and soft γ's ($E\gamma$ below 100 keV), because of the attenuating power of the materials making up the source, the measuring apparatus and the comparatively high ionizing power of low-energy x and γ rays (predominant photoelectric effect). Author (NSA)

N67-21684# California Univ., Livermore. Lawrence Radiation Lab.
PRACTICAL APPLICATIONS OF STOCHASTIC ANALYSIS OF COUNTING RATE MEASUREMENTS
Robert J. Gelinas Oct. 1966 24 p refs
(Contract W-7405-ENG-48)
(UCRL-50146) CFSTI: HC $3.00/MF $0.65

Some of the more latent principles of stochastic analysis are briefly reviewed in order to provide a common base of understanding and terminology for ensuing discussion and developments. Particular emphasis is devoted to a description of the quantities that are conveniently measured in actual experimental measurements. The essence of how these macroscopic observables then relate to microscopic causal mechanisms within an interacting system will be indicated in order to illustrate the ultimate power of stochastic measurements. Finally a number of stochastic experiments that may now have become quite feasible (in view of recent improvements in measuring techniques) are suggested. NSA

N67-21686# Commissariat a l'Energie Atomique, Fontenay-aux-Roses (France).
THE EFFECT OF A HOMOGENEOUS MAGNETIC FIELD ON THE LINE PROFILES OF HYDROGEN [EFFET D'UN CHAMP MAGNETIQUE UNIFORME SUR LES PROFILS DES RAIES DE L'HYDROGENE]
Nguyen-Hoe, Hans-Werner Drawin, and Louis Herman Aug. 1966 70 p refs In FRENCH
(CEA-R-3057; EUR-2972.f) CFSTI: HC $3.00/MF $0.65

The profiles of the hydrogen lines have been calculated taking into account the intermolecular electric field, the electronic collisions, and an external homogeneous magnetic field in which the plasma is imbedded. Electron densities N within the range $10^{15} \leq N \leq 10^{18}$ cm^{-3} and magnetic field strengths $\leq 1.2 \times 10^5$ gauss are considered. These values cover most of the experimental conditions in which one is interested in the present state of research. Numerical results are presented for the lines Ly-α, Ly-β and H-α. For very small magnetic fields the calculated line profiles coincide with the pure Stark profiles recently calculated by Griem, Kolb and Shen. With increasing magnetic fields, important deviations appear. The essential parameters for these deviations are: firstly, the direction of observation with regard to the direction of the magnetic field; and secondly, the ratio between Zeeman splitting in a magnetic field only and the Stark splitting due to the mean intermolecular electric field. Experimental line profiles have been obtained using a linear discharge tube surrounded by an induction coil. The comparison of the theoretical profiles with the experimental ones shows a satisfying agreement. Author (NSA)

N67-21690# Brookhaven National Lab., Upton, N. Y.
EQUIVALENT CIRCUIT AND DISPERSION RELATION FOR THE MULTISTEM DRIFT TUBE STRUCTURE
T. Nishikawa 18 Nov. 1966 10 p refs
(Contract AT(30-2)-GEN-16)
(BNL-10834) CFSTI: HC $3.00/MF $0.65

The coupled dispersion curves for TS and TM modes in terms of an equivalent circuit for the multistem structure are considered. It is pointed out also that the lumped circuit constants determined from the measured frequencies have a reasonable N-dependence for the N = 1, 2, 3, and 4 stem structures. NSA

N67-21707# Naval Research Lab., Washington, D. C.
THE EFFECT OF LIQUID STRUCTURE ON CONTACT ANGLE HYSTERESIS Interim Report
C. O. Timmons and W. A. Zisman 29 Sep. 1966 16 p refs
(NRL-6436; AD-644617) CFSTI: HC $3.00/MF $0.65

Contact angle hysteresis was measured for a variety of liquids on condensed monolayers of 17-(perfluoroheptyl)-heptadecanoic acid adsorbed on polished chromium. The hysteresis was shown to be simply related to the molecular volume of the liquid and to result from the penetration of liquid molecules into the porous monolayer. However, contact angle hysteresis was negligible when the average diameter of the liquid molecules was larger than the average cross-sectional diameter of the intermolecular pores. It is shown that it is possible to estimate intermolecular pore dimensions of such adsorbed monolayers by contact angle hysteresis measurements on a series of liquids having gradations in molecular volume. The results of this investigation reveal that liquid penetration, even into pores of molecular dimensions, is a cause of significant contact angle hysteresis, and it is also shown how liquids can be selected for contact angle investigations on organic solid surfaces so that there will be freedom from this source of hysteresis. Author (TAB)

N67-21722# Cambridge Language Research Unit (England).
ON THE ORIGIN OF THE SCALE-CONSTANTS OF PHYSICS
E. W. Bastin May 1966 38 p refs
(Grant AF-EOAR-65-78)
(AFOSR-66-2862; AD-644486) CFSTI: HC$3.00/MF$0.65

An approach is presented to the problem of describing a particle in a field without assuming a space-time continuum that is deduced primarily from simple assumptions concerning interactions between the elements of a bootstrap-type assemblage in which each particle in the assemblage is built from the interactions of all of the others. No dynamic properties are assumed for the particles beyond the discrete all-or-none interactions. Dynamics, including the momentum concept, are formulated subsequently. Numerical values are found that are identified as measures of the strengths of the main fields of physics that interact with particles. These are assumed to specify dimensionless ratios of the natural units, or fundamental constants, that are ultimately required to specify every measurement, and therefore, every particular value of each continuous dynamic variable, irrespective of how that concept is subsequently defined. The numbers identified with the dimensionless ratios are called scale-constants.
Author (TAB)

N67-21731# California Inst. of Tech., Pasadena.
MODIFICATION OF THE EFFECTIVE PARTICLE-HOLE INTERACTION BY CORE POLARIZATION
N. de Takacsy Dec. 1966 20 p refs
(Contract Nonr-220(47))
(AD-645242) CFSTI: HC$3.00/MF$0.65

The second order core-polarization corrections to the effective particle-hole force were calculated using a central potential with Rosenfeld exchange mixture. These corrections do not seem to seriously alter the spectrum of the particle-hole states of oxygen-16.
Author (TAB)

N67-21748# Kernforschungsanlage, Juelich (West Germany). Zentralbibliothek.
BIBLIOGRAPHIES DEALING WITH NUCLEAR SCIENCES [LITERATURZUSAMMENSTELLUNGEN AUS DEN GEBIETEN DER KERNWISSENSCHAFTEN]
M. Wittenberg, comp. Oct. 1964 12 p refs In GERMAN
(JUL-BIBL-7) CFSTI: HC$3.00/MF$0.65

A bibliography is presented on the following topics for application to nuclear science: biology and medicine; geology; mineralogy; radiation protection; instrumentation; isotope techniques; mathematics and computers; metals, ceramics, and other materials; physics; reactor technology; and fallout disposal. Under the main divisions, such topics are included as: excretion of amino acids, decontamination measures, corrosion inhibition of technetium, surface evaluation by gas chromatography techniques, X-ray spectrometry, lattice structure of uranium hydride, radiation effect on calcite, pipe lines for liquid hydrogen, pressure drop and heat transfer in two-phase flow, and measurement of high doses of gamma radiation.
Transl. by R.Ll.

N67-21757# Istituto Superiore di Sanita, Rome Laboratori di Fisica.
THE A(e, e'x)R REACTIONS IN IMPULSE APPROXIMATION [LE REAZIONI A(e, e'x)R IN APPROSSIMAZIONE IMPULSIVA]
S. Frullani 18 Nov. 1966 50 p refs In ITALIAN; ENGLISH summary
(ISS-66/45) CFSTI: HC$3.00/MF$0.65

The processes (e, e'x) in which high energy electrons induce knockout reactions on nuclei ejecting the x sub-unity (nucleon or cluster) are studied. The cross section formula in impulse approximation is deduced, in the most general case, without the complanar events restriction. A brief survey of formal theory of scattering is also reported.
Author

N67-21764# International Centre for Theoretical Physics, Trieste (Italy).
COMPARISON BETWEEN THE TWO-QUASIPARTICLE AND FOUR-QUASIPARTICLE TAMM-DANCOFF APPROXIMATIONS FOR EVEN PARITY STATES OF EVEN TIN ISOTOPES CALCULATED WITH FINITE RANGE FORCES
P. L. Ottaviani (Comitato Nazl. per l'Energia Nucl., Bologna), M. Savoia (Bologna Univ.), and J. Sawicki Feb. 1967 28 p refs Submitted for publication
(IC/67/5) CFSTI: HC$3.00/MF$0.65

The quasiparticle second Tamm–Dancoff theory is applied to the study of even-parity states of even tin isotopes, and compared with the quasiparticle Tamm–Dancoff theory. Numerical computations were performed with several Gaussian and P_2 residual interaction potentials. In contrast to previous results with a delta force, here reasonable finite range forces permit accounting for the 0^+ states as well as for the 2^+ and 4^+ states. Four-quasiparticle correlations are included in the ground state. The spurious states of the nucleon number operator are projected out. While the first excited 2^+ and 4^+ states are generally of almost pure two-quasiparticle character, the first excited 0^+ state is quite of the 2 qp–4 qp mixed type. The E2-transition probabilities and Q_2, the quadrupole moments of the 2^+ states are calculated and discussed.
Author (ESRO)

N67-21769# Aktiebolaget Atomenergi, Studsvik (Sweden).
THE HALF LIFE OF THE 53 keV LEVEL IN ^{197}Pt
Sven G. Malmskog Feb. 1967 12 p refs
(AE-266) CFSTI: HC$3.00/MF$0.65

The half life of the recently proposed 53 keV level in Pt^{197} has been measured to 18.5±1.5 nsec using the delayed coincidence technique. This level, which is identified with the $f_{5/2}$ single particle state, decays directly to the $p_{1/2}$ ground state in Pt^{197}. The reduced E2 transition probability for this 53 keV transition has been deduced and compared with the results obtained for the corresponding transitions in other Pt, Hg, and Pb isotopes and with the theoretical predictions by Sorensen and by Wahlborn and Martinson.
Author (ESRO)

N67-21773# Aktiebolaget Atomenergi, Stockholm (Sweden).
BURN-UP DETERMINATION BY HIGH RESOLUTION GAMMA SPECTROMETRY: AXIAL AND DIAMETRAL SCANNING EXPERIMENTS
R. S. Forsyth, W. H. Blackadder, and N. Ronqvist Feb. 1967 20 p refs
(AE-267) CFSTI: HC$3.00/MF$0.65

In the gamma spectrometric determination of burn-up the use of single fission product as a monitor of the specimen fission rate is subject to errors caused by activity saturation or, in certain cases, fission product migration. Results are presented of experiments in which all the resolvable gamma peaks in the fission product spectrum have been used to calculate the fission rate; these results form a pattern which reflect errors in the literature values of the gamma branching ratios, fission yields etc., and also represent a series of empirical correction factors. Axial and diametral scanning experiments on a long-irradiated low-enrichment fuel element are also described and demonstrate that it is possible to differentiate between fission in U-235 and in Pu-239 respectively by means of the ratios of the Ru-106 activity to the activities of the other fission products.
Author (ESRO)

N67-21782# Carnegie Inst. of Tech., Pittsburgh, Pa. Dept. of Chemistry.
NUCLEAR CHEMISTRY RESEARCH OF HIGH ENERGY NUCLEAR REACTIONS AT CARNEGIE INSTITUTE OF TECHNOLOGY Annual Progress Report, 1965–1966
1 Jun. 1966 89 p refs
(Contract AT(30-1)-2897)
(NYO-2897-17) CFSTI: HC$3.00/MF$0.65

The mechanisms contributing to (p,xn) reactions were investigated in a systematic study of (p,xn) reactions on nuclei with A = 56 to 126. The dependence of Cd(p,xn)In reactions at 400 MeV on the target neutron number was also studied; the production cross sections and decay properties of ^{107}In, ^{109}In, and ^{111}In were measured. The production of ^{111}In was investigated as a function of the mass numbers of cadmium isotopes and of the proton energy between 700 and 400 MeV. In addition, the (p,2p) reaction on ^{112}Cd, ^{113}Cd and ^{114}Cd at 400 MeV was studied; the decay properties of ^{111}Ag, ^{112}Ag, and ^{113}Ag were measured as well as the reaction cross sections. Excitation functions for the reactions ^{25}Mg(p,2p)^{24}Na and ^{26}Mg(p,2pn)^{24}Na were measured between 100 and 400 MeV in a study of mechanisms involved in (p,2pxn) reactions. The isomer ratios of ^{117}In produced in ^{118}Sn(p,2p)^{117}In reactions at 330, 430, 590, and 18,000 MeV were also measured as were the reaction cross sections. The recoil properties and formation cross sections of several Pd and Ag nuclides formed in the bombardment of natural In and Ag by 200- to 400-MeV protons were measured, and the cross sections and recoil properties of the reactions ^{103}Rh(p,pπ^-)^{103}Pd and ^{103}Rh(p,pπ^+)^{103}Ru at 18 GeV were experimentally determined. NSA

N67-21785# Lyon Univ. (France). Institut de Physique Nucleaire.
APPLICATION OF PERTURBATION METHOD FOR MEASURING ELECTROMAGNETIC FIELD IN RESONANT CAVITIES. REALIZATION OF A SET OF MEASUREMENTS [APPLICATION DE LA METHODE DES PERTURBATIONS A LA MESURE DU CHAMP ELECTROMAGNETIQUE DANS DES CAVITES RESONNANTES. REALISATION D'UN BANC DE MESURES]
Gilles Voisin 5 Jul. 1966 78 p refs
(LYCEN-6627) CFSTI: HC $3.00/MF $0.65

The development of a set of procedures for measuring the electromagnetic field in resonant cavities based on the perturbation method is described. The perturbation method reduces the determination of fields to measurements of frequency variations caused by the introduction of perturbing objects in the interior of the area studied. The general formulas are derived in an original manner and practical applications are deduced. The experimental setup is described. The principles of its design are given, and its various elements are analyzed. The performances obtained are described. A comparative study is made of different forms of usable perturbing objects. Some experimental results obtained are reported. NSA

N67-21787# Los Alamos Scientific Lab., N. Mex.
MEASUREMENT OF AVERAGE CROSS-SECTION RATIOS IN FUNDAMENTAL FAST-NEUTRON SPECTRA
J. A. Grundl and G. E. Hansen 1966 20 p refs Presented at the IAEA Conf. on Nucl. Data, Paris
(Contract W-7405-ENG-36)
(LA-DC-7851; CONF-661014-4) CFSTI: HC $3.00/MF $0.65

Spectral indices (energy-sensitive average cross-section ratios) are presented for the fast neutron spectra at the center of bare and nautral-uranium-reflected spheres of ^{239}Pu, ^{233}U, and ^{235}U. By means of energy-sensitive nuclear reactions, the six fast critical assembly spectra are compared (1) among themselves, (2) to corresponding fission-neutron spectra, and (3) to neutrons of a single energy. Experimental errors depend upon reproducibility of detecting systems, spectral distortions due to the presence of detecting systems, and purity of the monoenergetic and fission neutrons. Recommended excitation functions and estimated uncertainties are presented for each detector reaction in coarse group structures for computational checks. The observed spectral indices and detector excitations, together with their uncertainties, provide a set of values that must be met by the microscopic cross sections ^{239}Pu, ^{233}U, and ^{235}U via transport computation. NSA

N67-21793# Rensselaer Polytechnic Inst., Troy, N. Y. Dept. of Chemistry.
SOME STUDIES OF THE IONIZING RADIATION INDUCED ISOTOPE EXCHANGE IN GASEOUS NITROGEN
R. D. Brown, S. Dondes, and P. Harteck Oct. 1966 167 p refs
(Contract AT(30-3)-321)
(RPI-321-9) CFSTI: HC $3.00/MF $0.65

The gas phase isotopic exchange of $^{14}N_2$ with $^{15}N_2$ under ionizing radiation has been studied in a number of systems important to the ionizing radiation induced fixation of nitrogen. A limited number of experiments were done at temperatures greater than the ambient temperature of the Brookhaven National Laboratory Graphite Research Reactor. Some experiments were also performed using a ^{60}Co source and some utilizing the fission products of ^{235}U. The results indicate that a mixture of $^{14}N_2$ and $^{15}N_2$ free of oxygen or other impurities undergoes isotopic exchange to form $^{14}N^{15}N$ with a G_N value of 11.5±1.0. The mechanisms of this isotopic exchange are believed to be the random recombination of nitrogen and a type of molecular exchange. Experiments in which oxygen was added to the isotopic nitrogen mixture showed a decrease in G_N with increasing concentration of oxygen. It appears that the primary role of oxygen is to remove nitrogen ions from the system by charge transfer thus preventing nitrogen atoms from forming as a result of ion recombination. Oxygen also appears to quench excited nitrogen molecules. Experiments were conducted using mixtures of either ^{15}NO or $^{15}NO_2$ in isotopically natural nitrogen. G_N was found to be 2.0 to 2.6. Similarly conducted experiments in which isotopically natural nitric oxide or nitrogen dioxide was added to a mixture of $^{14}N_2$ and $^{15}N_2$ showed G values 2.0 to 2.5 units higher than those in which the oxide was labeled. It is believed that this increase represents the G value for the molecular types of isotopic exchange. The results obtained from the irradiation of mixtures of $^{14}N_2O$ and $^{15}N_2O$ were utilized in developing a new method for determining the thermal neutron component of a mixed radiation field. These same experiments showed that nitrous oxide is reformed during its decomposition and confirmed that $N_2O \rightarrow N_2 + O$ is the primary step of the radioinduced decomposition. Mixtures of each of the rare gases with nitrogen were also irradiated. The mechanisms of isotopic exchange in these mixtures is undoubtedly very complicated and may even be specific for each mixture. For the helium–nitrogen mixture it was found that the isotopic exchange was greater than in pure nitrogen. NSA

N67-21795# Academia R.P.R., Bucharest. Institutul de Fizica Atomica.
A GENERAL SOLUTION OF THE ONE-CHANNEL SCATTERING SINGULAR INTERGRAL EQUATIONS
S. Ciulli, Gr. Ghika, M. Stihi, and M. Visinescu 1966 44 p
(IFA-FT-58) CFSTI: HC $3.00/MF $0.65

Integral equations for the one-channel scattering are written and solved, starting from dispersion relations for the generalized Jost function in the momentum k-plane. This method is an alternative to the conventional N/D method, but it allows a simple, physically meaningful generalization to the many-channel case, where dispersion relations and integral equations can be written for a unique generalized Jost function in the complex plane of a suitable variable which uniformizes all the right cuts of the scattering amplitude. Even in the pure elastic scattering case, a unfied treatment is possible for both cases, when the phase shift at infinity is or is not an integral multiple of π. In all cases, our singular integral equations are reduced to a Fredholm-type integral equation with a Hilbert–Schmidt kernel. Author (NSA)

N67-21796# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems.
PHASE-SHIFT ANALYSIS OF NUCLEON–NUCLEON SCATTERING AT 400 MeV

Yu. M. Kazarinov, F. Legar, and Z. Yanout 1966 16 p refs
(JINR-E-2743) CFSTI: HC$3.00/MF$0.65

New experimental data were used to specify the phase-shift analysis of the nucleon–nucleon scattering at 400 MeV. As a result of this specification two phase-shift sets remain from the previously obtained three ones. Author (NSA)

N67-21798# Oesterreichische Studiengesellschaft fuer Atomenergie G.m.b.H., Seibersdorf.

A HIGH-PRESSURE VESSEL FOR THE MEASUREMENT OF PRESSURE-INDUCED PHONON ENERGY SHIFTS BY INELASTIC SCATTERING OF NEUTRONS

Ruep. Lechner 28 Apr. 1966 20 p refs
(SGAE-PH-43/1966) CFSTI: HC$3.00/MF$0.65

A pressure vessel for neutron inelastic scattering experiments at 3000 atm maximum pressure is described. Rather thin walls with good neutron transmission properties are obtained by composing the vessel of five cylinders made of a high-strength aluminum alloy which are shrunk one upon another. This compound cylinder has a total wall-thickness of only 13.5 mm for a (cylindrical) sample volume of 30.6 mm diameter and 65 mm length. The whole range 2π of scattering angles is accessible. Certain relations are discussed which were used for calculating optimal cylinder dimensions. Experiments with a lead single crystal show a reduction of Bragg peak intensity of 76% if the crystal is mounted in the vessel. A typical measurement at 3000 atm gives an increase of 2% in phonon energy. Author (NSA)

N67-21804# Academia R. P. R., Bucharest. Inst. de Fizica Atomica.

STABLE ISOTOPES APPLICATIONS. II APPLICATION IN PHYSICS, CHEMISTRY, AND GEOLOGY

Gheorghe Vasaru 1966 47 p refs Transl. into ENGLISH from Studii Cercetari Fiz. (Bucharest), v. 16, no. 6, 1964 p 701–728
(IFA-IS-36)

Stable isotopes may be used either as tracers or as pure monoisotopic materials. As a tracer, the stable isotope will follow the chemical which it represents. When using it as a pure material, it influences the process in which it takes part. Applications of stable isotopes in geology, chemistry, and physics are described. One hundred thirty-two references are included. NSA

N67-21807# Kansas Univ., Lawrence. Dept. of Chemistry.

PARAMAGNETIC RELAXATION CHARACTERISTICS OF TRAPPED ELECTRONS AND HYDROGEN ATOMS IN IRRADIATED FROZEN AQUEOUS SOLUTIONS

Larry Kevan 26 Jun. 1966 15 p Presented at the 3d Intern. Congr. on Radiation Res., Cortina (Italy), 26–31 Jul. 1966
(Contract AT(11-1)-1528)
(COO-1528-7; CONF-660614-4) CFSTI: HC$3.00/MF$0.65

Paramagnetic relaxation experiments designed to probe the nature of the trapping site of trapped H atoms and electrons are described. Studies on gamma irradiated frozen NaOH, H_2SO_4, and H_2O led to the conclusion that the electron is trapped in an anion vacancy which is located within a radiation-produced spur. However, the H atom is not trapped in a spur but is presumably trapped in an interstitial position in the region of an oxyanion. If T_1 for a given trapped species varies in different matrices (glassy or polycrystalline) the trapping probability in these matrices appears to be a function of the reciprocal of T_1. NSA

N67-21812# United Kingdom Atomic Energy Authority, Culham (England).

BEAM NEUTRALIZER FOR INTENSE ION BEAMS

V. I. Butusov, P. A. Mukhin, and V. S. Svishchev Jun. 1966 13 p refs Transl. into ENGLISH from Kurchatov Rept. IAE-1098, Apr. 1966 p 1–5
(NP-TR-1432; CTO-300; IAE-1098)

To obtain a flux of fast hydrogen atoms for injection into the magnetic trap in Ogra-II, a target in the form of a supersonic gas jet crossing the ion stream is used. The gas is condensed at the cold surfaces of the neutralization chamber. Two types of target, carbon dioxide and magnesium vapor, are investigated. Disadvantages of the CO_2 target led to the development of a magnesium target which gives a large yield of excited atoms with an energy of 20 keV. The design of the neutralizer and the auxiliary equipment for controlling the magnesium vapor jets are described. NSA

N67-21822# Brookhaven National Lab., Upton, N. Y. Accelerator Dept.

GROWTH OF PHASE SPACE IN HIGH INTENSITY PROTON BEAMS DUE TO NONUNIFORM RADIAL CHARGE DISTRIBUTION

C. M. Turner and G. W. Bennett 28 Jul. 1966 22 p refs
(Contract AT(30-2)-GEN-16)
(BNL-10528; AADD-114) CFSTI: HC$3.00/MF$0.65

Experimental results are presented of work aimed at establishing quantitative information on the rate of growth of apparent emittance area in the drifting high-intensity proton beams with nonuniform radial charge distributions considered by Blewett. NSA

N67-21829# California Univ., Berkeley. Lawrence Radiation Lab.

K^+p INELASTIC INTERACTIONS AT 2.7 BeV/c

Riley David Newman (Ph.D. Thesis) Jul. 1966 73 p refs
(Contract W-7405-ENG-48)
(UCRL-17003) CFSTI: HC$3.00/MF$0.65

An analysis is presented of an exposure of the hydrogen bubble chamber to a 2.65 Bev/c separated K^+ beam. Channel cross sections are presented for K^+p interactions, except those corresponding to a two prong topology. A detailed study is made of the final states $K^0p\,\pi^+$ and $K^+p\,\pi^+\pi^-$, which are dominated by the production of $K^*(891)$ and $N^*(1236)$. The reaction $K^+p \rightarrow K^*p$ is analyzed in terms of a one-meson-exchange model modified by form factors, and results are compared with data at other energies. The model is found to give a very unsatisfactory account of the energy dependence of K^* production. The reaction $K^+p \rightarrow K^{*0}N^{*++}$ is analyzed in terms of a pion exchange model modified to include the effects of absorption in intial initial and final states. No evidence is found for production of resonant states other than $K^*(891)$, $N^*(1236)$, and ω. Relations between three body final states of K^+p reactions implied by SU_3 symmetry are derived and tested. Author (NSA)

N67-21830# Grand Junction Office (AEC), Colo. Div. of Raw Materials.

SUPPLEMENT TO THE REPORT OF THE MONTICELLO MILL TAILING EROSION CONTROL PROJECT, MONTICELLO, UTAH

20 Apr. 1966 9 p refs
(RMO-3005; Suppl.)

Supplemental information is presented on the project to stabilize and cover the tailing ponds at the Government-owned millsite in order to prevent wind erosion and air transport of fine tailings, and to prevent tailings from being washed into an adjacent natural stream, thereby eliminating the possibility of radioactive contamination. Approximately 900,000 tons of low-level radioactive solid residues (tailings) impounded in four separate areas, totaling about 40 acres, were stabilized and covered. The tailings were stabilized, leveled, and graded to facilitate drainage, and were then covered with a rock and soil surface. Finally, after fertilizing, grasses were sown to prevent surface erosion. Inspections and surveys have revealed that surface soil erosion has been of a minor nature and there has been no evidence of radioactive material transport from the tailing areas. NSA

N67-21831# Purdue Research Foundation, Lafayette, Ind.
RESEARCH IN NUCLEAR PHYSICS Progress Report
R. M. Steffen et al 15 Jun. 1966 56 p refs
(Contract AT(11-1)-1420)
(COO-1420-124; PR-16) CFSTI: HC $3.00/MF $0.65

Brief summaries of research on various nuclear reactions are presented. Results of an investigation on isobaric spin conservation in the reaction $Ca^{40}(d,\alpha)K^{38}$ are presented. The fabrication and use of Ge(Li) detectors for gamma–gamma angular correlation measurements are described. NSA

N67-21835# Soreq Research Establishment, Israel Atomic Energy Commission, Yavneh.
ENERGY DISTRIBUTION OF ENERGETIC ATOMS IN A GASEOUS MEDIUM. I: ELASTIC SCATTERING OF PARTICLES BY SPHERICAL POTENTIALS OF THE FORM $V(r) = A_1/r^{s1} + A_2/r^{s2}$
M. Baer and S. Amiel Aug. 1966 36 p refs
(IA-1091)

The energy distribution function n(E) for energetic particles in a gaseous medium is treated (classically) assuming elastic scattering governed by a two-term spherical potential of the form $V(r) = A_1/r^{s1} + A_2/r^{s2}$. It was found that in the energy interval from 1 MeV to 1 keV, n(E) differs from that computed for a single-term potential, but it makes almost no difference whether the second (long range) component is of an attractive or repulsive nature. In the low energy range (<1 keV), if the long range component is repulsive it almost completely screens the short range one (which is always assumed to be repulsive). If it is attractive it lowers the values of n(E) in comparison with those obtained with a repulsive long range term. The calculations also show that n(E) is almost independent of the initial energy of the incoming particles. The results can be applied to the calculation of the yields of chemical reactions caused by energetic atoms such as fission fragments. One of the implications which emerges is that the yields of the reactions would not be influenced by the initial spectrum of the energetic atoms, since this has practically no effect on n(E) provided that the atoms behave like material points. Author (NSA)

N67-21863# California Inst. of Tech., Pasadena.
NON-EXISTENCE OF A LEVEL AT 1.35 MeV IN S-33
C. E. Moss Dec. 1966 8 p refs
(Contract Nonr-220(47))
(AD-645244) CFSTI: HC $3.00/MF $0.65

A natural sulfur target was bombarded with 2.541 MeV deuterons and the emitted protons were observed with a magnetic spectrometer. The peak tentatively attributed earlier to a level at an excitation energy of 1.35 in sulfur-33 is shown to be due to levels in sulfur-34 at excitation energies of 4.08 and 4.12 MeV. Author (TAB)

25 PHYSICS, PLASMA

Includes magnetohydrodynamics. For applications see: 28 Propulsion Systems.

N67-20487# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
FOR THE EXCITATION OF WAVES IN LIMITED PLASMA BY A MODULATED STREAM
A. M. Kondratenko *In its* Ukrain. J. of Phys. (Selected Articles) 27 Sep. 1966 p 5–8 refs (See N67-20485 10-24) CFSTI: HC $3.00/MF $0.65

Wave excitation in limited plasma was investigated, and an attempt made to calculate the nonlinearity of plasma. The stream in this case is considered as given and not affected by the wave movement of stream particles. For two specified cases, a layer of plasma was examined which was boundless in two directions and limited by two parallel metal plates. First, a linear approximation was made for the field of the wave at an arbitrary law of dispersion. Secondly, the field of the wave in nonlinear hydrodynamic approximation was made. Equations are derived, in the case of both high and low frequency oscillations, for the field amplitude of the wave in the resonance. In both high and low frequency oscillations, the amplitude of the field of the excited wave will be limited by nonlinearity. R.Ll.

N67-20612# California Inst. of Tech., Pasadena. Antenna Lab.
ELECTROMAGNETIC REFLECTIVITY OF NONUNIFORM JET STREAMS
H. N. Kritikos, K. S. H. Lee, and C. H. Papas Dec. 1966 18 p refs
(Contract AF 49(638)-1266)
(TR-38; AD-644871) CFSTI: HC $3.00/MF $0.65

The reflection coefficient of a plane monochromatic electromagnetic wave incident on an idealized laminar plane stratified jet stream is determined. This is accomplished by applying the principle of invariant imbedding to derive a differential equation for the reflection coefficient. The differential equation which is of the Riccati type is solved approximately for the case of a jet stream with a parabolic velocity profile. Author (TAB)

N67-20624# Applied Physics Lab., Johns Hopkins Univ., Silver Spring, Md.
STUDIES OF BEAM-PLASMA INTERACTIONS IN A MAGNETIC FIELD
John R. Apel Jun. 1966 132 p refs
(Contract NOw-62-0604-c)
(TG-821; AD-644695) CFSTI: HC $3.00/MF $0.65

The interactions between a warm plasma and an electron beam, both immersed in a uniform magnetic field, were investigated theoretically and experimentally. The theoretical problem considered was that of growing waves in a cylindrical beam and plasma of equal radii propagating in a half-space $z > 0$, and surrounded by a perfectly conducting cylinder having either radius a or infinity. Implicit dispersion equations yielding k = k(omega) are given which incorporate many of the important facets of a laboratory plasma, and solutions are obtained for certain cases. Experiments were performed with an electron beam and a plasma whose properties and geometrical configuration were as close to those of the theoretical model as practicable. The interaction that leads to the growing wave is shown to arise from the coupling of the electron-cyclotron wave in the plasma and the doppler-shifted electron-space-charge wave in the beam. Approximately 10 percent of the beam power was converted into oscillatory power by the time the wave growth had reached a nonlinear limit. Author (TAB)

N67-20670# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
GAS-DISCHARGE SOURCES OF IONS AND ATOMS WITH A GLOWING CATHODE
O. V. Kozlov, Yu. A. Skoblo, and A. V. Charnetskiy 29 Aug. 1966 11 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zved., Aviats. Tekh. (Kazan), no. 2, 1965 p 87–91
(FTD-HT-66-318; TT-67-60247; AD-643932) CFSTI: HC $3.00/MF $0.65

The article introduces the results of work on sources with uninterrupted and pulsed regimes. Special attention is devoted to obtaining a well focused ion bundle and significant densities of the ion flux on a collector that is some distance (from several tens of centimeters to several meters) from the source. The source was used for probing the plasma with beams of fast particles. Author (TAB)

N67-20696# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
INTERACTION OF A MODULATED BEAM WITH A PLASMA
Ya. B. Faynberg and V. D. Shapiro 29 Jul. 1966 17 p refs Transl. into ENGLISH from Atomnaya Energ. (Moscow), v. 19, no. 4, 1965 p 336–342
(FTD-HT-66-302; TT-67-60245; AD-643930) CFSTI: HC $3.00/MF $0.65

The work examines the excitation of longitudinal waves during the interaction of a modulated beam of electrons with a plasma. The conditions for the appearance of instability and also the frequency spectrum and the increments of increase in oscillations are found. Author (TAB)

N67-20733# Groningen Rijksuniversiteit (Netherlands).
DIFFUSION OF A WEAKLY IONIZED PLASMA IN A MAGNETIC FIELD
Jan Polman (Ph.D. Thesis) 1966 108 p refs
(NP-16363)

A theoretical description is given of an axially decaying plasma based on the assumption that the plasma transport processes are controlled by elastic collisions between charged particles and neutrals. The plasma instabilities involved are discussed. Experimental arrangements and diagnostic methods are described. NSA

N67-20757# United Kingdom Atomic Energy Authority, Culham (England).
NON ADIABATIC INJECTION OF PLASMA INTO THE L-2 STELLARATOR WITH N = 2
O. I. Fedyanin, U. V. Kholkov, and V. L. Zubkov Aug. 1966 22 p refs Transl. into ENGLISH from Russian
(CTO/312; NP-TR-1430) CFSTI: HC $3.00/MF $0.65

Results are reported of an experimental investigation of the possibility of injection into, and filling, a closed toroidal trap with helical magnetic field with n = 2 (L-2). The plasma is injected using the programmed magnetic field method. The injected plasma is captured in the trap which it fills within 150 to 200 μsec; the quasi-stationary plasma density on establishment of equilibrium, is $\approx 2.3 \times 10^{10}$ cm^{-3}. Author (NSA)

N67-20818# Stanford Univ., Calif. Inst. for Plasma Research.
STUDIES OF PLASMA OSCILLATIONS Quarterly Status Report, 1 Jun.–31 Aug. 1966
F. W. Crawford et al Sep. 1966 40 p refs
(Contract AT(04-3)-326)
(SU-IPR-106; QSR-27) CFSTI: HC $3.00/MF $0.65

Investigations were made of instabilities occurring in discharges at pressures of the order of 1 mtorr, with the intention of determining: where and how they are excited in the discharge; how perturbations due to the instabilities propagate through the plasma; and whether it is possible to eliminate any or all of the sources of instability. NSA

N67-20866# Sydney Univ. (Australia). Dept. of Theoretical Physics.
THE STEEPENING OF FINITE AMPLITUDE ALFVEN WAVES
B. J. Green Jul. 1966 22 p refs
(TR-19; NP-16322)

The steepening (to shock discontinuities) of plane-polarized Alfven waves of finite amplitude, which propagate parallel to a steady magnetic field in a fully ionized plasma, was investigated. The theory used is valid to the second order, and is compared with results obtained in an experimental study of these waves. Author (NSA)

N67-20882# Stanford Univ., Calif. Nuclear Technology Lab.
TEMPERATURE MEASUREMENT AND INTERNAL FLOW HEAT TRANSFER ANALYSIS FOR PARTIALLY IONIZED ARGON
F. P. Incropera Aug. 1966 179 p refs
(Contract AT(04-3)-247)
(SU-247-11) CFSTI: HC $3.00/MF $0.65

From a review of the arc jet literature, three techniques are found to be best suited to the task of plasma jet temperature measurement. Two of these techniques are spectroscopic and are referred to as the Larenz and two-line methods, and the third is calorimetric and operates by insertion of a probe in the plasma stream. An uncertainty analysis performed on each of the selected methods indicates that the most suitable spectroscopic technique is one which combines the ion-neutral, two-line method with the Larenz method. Spectroscopic and calorimetric probe measurements of temperature profiles in the same argon plasma source agree to within 4 percent, which is also the expected uncertainty predicted from the analysis. For all of the measurements made the values of the flow rate and enthalpy obtained from integration of local measurements over the jet cross-section agree with the known flow rate and bulk enthalpy to within 10 percent. Criteria are proposed which may be used to select the diagnostic technique best suited to a particular application. Measurements of plasma jet acoustic power and mixing length, as well as visual and photographic studies, verify the existence of laminar, transitional, and turbulent flow regimes. Using a Reynolds number based on gas properties at the nozzle wall reveals that passage from a laminar to a transitional jet occurs at approximately the same Reynolds number as transition from laminar to turbulent flow for conventional fluids in a circular duct. This observation suggests that the principal source of turbulence in the plasma jet stems from turbulence generation at the nozzle walls. An analysis of the laminar flow of a plasma in the entrance region of a circular tube was performed using an implicit finite-difference scheme. Numerical results were obtained for an argon gas having a linear enthalpy and cubic velocity profile at the tube entrance. At the low temperature limit of the analysis, the friction factor is in agreement with previous results; and in all but a very small region near the tube entrance the local Nusselt number agrees with the Nusselt number for constant property, fully-developed flow to within approximately 17 percent. The implication of this result is remarkable when considered in light of the number of effects which influence the local convective heat transfer. NSA

N67-20884# Commissariat a l'Energie Atomique, Fontenay-aux-Roses (France). Center d'Etudes Nucleaires.
WAVES IN INHOMOGENEOUS PLASMA OF CYLINDRICAL GEOMETRY [ONDES DANS LES PLASMAS INHOMOGENES EN GEOMETRIE CYLINDRIQUE]
Paul-Henri Rebut (Ph. D. Thesis—Paris Univ.) 1966 71 p refs In FRENCH
(CEA-R-2960; EUR-2725.f)

The conductivity tensor of a hot and inhomogeneous plasma was a cylindrical geometry using Vlasov's equations. The method used consists in a perturbation method involving the first integrals of the unperturbed movement. The conductivity tensor will be particularly useful for dealing with stability problems. In the case of

a cold plasma the wave equation giving the electric fields as a function of the radius is obtained. This equation shows the existence of resonant layers which lead to an absorption analogous to the Landau absorption in a hot plasma. Author (NSA)

N67-20900# California Univ., Livermore. Lawrence Radiation Lab.
MECHANICAL DESIGN OF THE BASEBALL COIL AND PLASMA-TRAPPING CHAMBER
Robert E. Bathgate and William S. Neef, Jr. 23 Sep. 1966 22 p refs Presented at Symp. on Eng. Probl. of Controlled Thermonucl. Res., Gatlinburg, Tenn., 3–6 Oct. 1966 Submitted for publication
(Contract W-7405-ENG-48)
(UCRL-70026; CONF-661016-1) CFSTI: HC $3.00/MF $0.65

Basic calculations and design considerations of the "baseball seam" conductor and its corresponding vacuum chamber for plasma experiments in the Alice device are described. A discussion is presented of a structural failure encountered during magnet operation, and corrective measures which were taken. NSA

N67-20918# Gosudarstvennyi Komitet po Ispolzovaniyu Atomnoi Energii, Moscow (USSR). Institut Atomnoi Energii.
THERMALIZATION OF PLASMA IN TOKAMAK INSTALLATIONS [TERMOIZOLYATSIYA PLAZMY V USTANOVKAKH TOKAMAK]
G. A. Bobrovskii, S. V. Mirnov, K. A. Razumova, and V. S. Strelkov [1966] 20 p refs In RUSSIAN
(IAE-1154) CFSTI: HC $3.00/MF $0.65

A measure of the thermal insulation efficiency is the term τ^e, which is defined from the condition that $\tau^e = W/[Q-(dw/dt)]$. Here W is the total energy of the plasma configuration, and Q is the amount of heat entering the plasma per unit of time. The term τ^e is called the energy retention time of the plasma. The kinetic energy of the plasma can be determined by measuring the diamagnetic effect: $W_{kin} = 3/4[I^2/e^2)-(H_z \Delta\phi/2\pi i)]$. Here I is the current strength; $\Delta\phi$ is the change in flow of the longitudinal magnetic field, and H_z is the field strength on the loop axis. The value of Q is calculated from measurements of current, voltage, and inductance of the plasma loop. The data are handled by computer. The results show that the kinetic energy content of the plasma increases with increasing initial pressure. The value of τ_E on the T-3 unit is very small at the beginning of the discharge, and attains a maximum of 4 msec at a time of 8 milliseconds after electric breakdown. The maximum W on the T-3 unit is shifted in phase 1 to 2 msec with respect to the current maximum. The radial distribution of n_e can be expressed as follows: $n_e = n_0 [1-(r^2/a^2)]$. Considerable cooling of the plasma is noted around the edges of the diaphragm. A large discrepancy is noted between electron temperatures measured by diamagnetism and by electrical conductivity. The causes for the energy losses in the Tokamak units are not known as yet. NSA

N67-20919# Kernforschungsanlage, Juelich (West Germany). Institut fuer Plasmaphysik.
WORK REPORT ON THE THEORETICAL AND EXPERIMENTAL GROUPS (IN PLASMA PHYSICS) FOR 1965 [ARBEITSBERICHTE DER THEORETISCHEN UND EXPERIMENTELLEN GRUPPEN FUER DAS JAHR 1965]
K. Vogelbruch, comp. Jun. 1966 108 p refs
(JUL-381-PP) CFSTI: HC $3.00/MF $0.65

Studies made in the theory of plasma physics, experimental production of high-temperature plasmas, acceleration of plasmas, plasma analysis, and engineering are summarized. Results are reported on the following: stability of one-dimensional plasmas, waves of finite amplitude in collision-free plasma with magnetic fields, stationary boundary layers between plasma and magnetic field, kinetic theory of radiation emission and absorption in plasma, mass determination in irreversible thermodynamics, calculations on a pulsed two-dimensional magnetic field, adiabatic invariants in one-dimensional fields, mathematical theory of pressure propagation of spectral lines, numerical treatment of θ pinch in magnetohydrodynamic approximation, studies on the plasma stability in the 600-kJ compression experiment, production and compression of plasma in cusp geometry, structure of collision waves in collision-free plasmas, density measurements on plasmoids, particle loss in the acceleration of plasma using a traveling-wave, high-voltage studies for a three-stage 80-kv plasma accelerator, determination for a three-stage of the plasma parameter for a continuous acceleration, production of traveling waves with h–f senders, electron loss processes in a decaying H plasma, gas ionization in homogeneous magnetic fields increasing linearly with time, determination of ionization degrees in electric fields at high electron densities, studies on stationary high-frequency ring discharges, static Stark effect, interactions between plasmas and neutral matter, comparison of the absolute intensities of the radiation of a high-temperature plasma in the visible region and in the region of soft x radiation, high intensity arcs, production of series limit continua, magnetic field measurements in plasma of a θ pinch, stability studies and interference measurements of a θ pinch, development of constructional elements for a microwave interferometer, studies on Rubin lasers, a trochoid spectrometer for plasma ions, construction of condenser batteries, technical developments for the construction of cusp experiments, Metallization of plastic surfaces, and production of a subprogram for Bessel functions. NSA

N67-20951# Oak Ridge National Lab., Tenn.
PLASMA-DENSITY MEASUREMENT IN A HOLLOW-CATHODE ARC BY ARC REVERSAL
I. Alexeff, W. Halchin, W. D. Jones, and J. F. Potts Sep. 1966 9 p refs Presented at the Joint Div. of Plasma Phys. and Am. Phys. Soc. Meeting, Minneapolis, 20–22 Jun. 1966
(Contract W-7405-ENG-26)
(ORNL-4010; CONF-660633-11) CFSTI: HC $3.00/MF $0.65

The average plasma density was measured in a magnetically supported, hollow-cathode arc ($n > 10^{14}$ cm^{-3}) by reversing the applied potential. At these high densities, the standard Langmuir probe and microwave techniques are difficult to use, while the "arc reversal" technique is remarkably simple. Since the hot cathode becomes the anode, and since the anode is cold and does not emit electrons, current flow and production of new plasma cease. The ionic charge escaping along magnetic flux lines to the cathode and anode can then be collected and measured. The average density of electrons in the arc is given by $n \simeq 2Q(Ve)^{-1}$, where Q is the charge collected after reversal, V is the volume of the arc, and e is the charge of an electron. From the time required for the ionic charge to escape, the ion temperature can be estimated. The electron temperature apparently can be found from the frequency of ionic sound waves shock-excited by the arc reversal. Author (NSA)

N67-20957# Maryland Univ., College Park. Inst. for Fluid Dynamics and Applied Mathematics.
INVESTIGATION OF UNIVERSAL PLASMA INSTABILITIES Quarterly Report, 1 Jun.–31 Aug. 1966
H. Lashinsky, E. Yadlowsky, and R. Abrams 1 Sep. 1966 4 p
(Contract AT(40-1)-3405)
(ORO-3405-9; QR-4) CFSTI: HC $3.00/MF $0.65

A brief outline is given on the research developments during this period. The developments concern various aspects of the experimental apparatus. NSA

N67-20999# Sydney Univ. (Australia). Wills Plasma Physics Dept.

PROPERTIES OF A LABORATORY PLASMA PREPARED WITH COMBINED TRANSVERSE AND AXIAL CURRENTS

I. G. Brown, J. A. Lehane, I. C. Potter, and C. N. Watson-Munro Aug. 1966 24 p refs Sponsored by Australian Inst. of Nucl. Sci. and Eng. and Australian Res. Grants Comm.
(ER-20; NP-16323)

It was found that a plasma prepared by a hybrid method with ionizing currents, both transverse and parallel to the steady magnetic field, has distinct advantages for certain experiments. The hybrid method of preparation is described along with results on the current distribution in the plasma and on the conditions limiting the use of this method. A detailed investigation of typical plasma produced by this method was made. The gross behavior of the plasma was studied with an image convertor camera; particle densities were determined from Stark spectral observations and from laser interferometry; electron temperatures from spectral observations and from plasma electrical conductivity. Alfvén waves were used to obtain information on total particle density, fractional ionization and electron temperature. The results are presented graphically to show the spatial and time variation of particle density and electron temperature. Author (NSA)

N67-21007# Kernforschungsanlage, Juelich (West Germany). Institut fuer Plasmaphysik.

PRODUCTION OF SERIES LIMIT CONTINUA WITH THE HELP OF SLIDING SPARKS FOR THE ABSOLUTE MEASUREMENT IN THE VACUUM ULTRAVIOLET [ERZEUGUNG VON SERIENGRENZKONTINUA MIT HILFE VON GLEITFUNKEN ZUR ABSOLUTMESSUNG IM VAKUUM-ULTRAVIOLETT]

H. Conrads Mar. 1966 47 p refs In GERMAN
(JUL-360-PP)

Triggerless sparks sources in high vacuum were developed and these produced for several hundred nanoseconds an intensive emission spectrum for excitation and ionization energies of at least 390 eV. From a Li plasma in the visible and infrared during this time, Bremsstrahlung of Li III, line radiation in the vacuum ultraviolet, and the recombination continua of Li III were emitted. Carbon plasmas show Bremsstrahlung of C IV line radiation of C V and C VI, and recombination continua of C V. The electron temperature T_e was determined from the absolute intensities in the infrared emitted from optically thick layers and the electron density N_e was determined from the intensities in the visible emitted by optically thin layers and by the strong broadening of the Lyman series of Li III. During the observation time the temperature decreases and the density increases constantly. Carbon plasmas with $T_e = 450{,}000°K$ for $N_e = 1.5 \times 10^{19}$ particles/cm^3 and Li plasmas with $T_e = 230{,}000°K$ for $N_e = 5 \times 10^{18}$ particles/cm^3 could be produced. For these temperatures and densities of the Li plasma the free electrons possess a Maxwell distribution, the response time for the ionization equilibrium is short compared with the oxidation time, and Li III is almost completely ionized so that the emission coefficients for recombination radiation can be calculated. The temperature is constant along the spark axis. The plasma layers possess a defined length so that the absolute intensities of the recombination continua can be determined. The absolute intensities of the series limit continua of the Lyman series of Li III determined from a simultaneous intensity measurement in the infrared, visible, and vacuum ultraviolet regions were given between 60 and 100 Å. Author (NSA)

N67-21018# Sydney Univ. (Australia). School of Physics.

WILLS PLASMA PHYSICS DEPARTMENT Eleventh Six-Monthly Progress Report, 1 Jan–30 Jun. 1966

30 Jun. 1966 12 p refs Sponsored by Australian Inst. of Nucl. Sci. and Eng. and Nucl. Res. Found.
(NP-16321)

Brief summaries of plasma research at Sydney are presented. The research includes work on plasma sources, compressional wave studies, large amplitude Alfvén waves, surface microwave reflections, longitudinal wave propagation, lasers, and the magnetic field of the moon. NSA

N67-21054# Commissariat a l'Energie Atomique, Fontenay-aux-Roses (France).

RESULTS OBTAINED FROM THE "BILLE EN TETE A" EXPERIMENT [RESULTATS EXPERIMENTAUX SUR BILLE EN TETE "A"]

Paul Evrard, Jean Jacquinot, Christian Leloup, Jean-Pierre Poffe, and Francois Waelbroeck Brussels, EURATOM, Nov. 1966 112 p refs In FRENCH; ENGLISH summary
(Contract EURATOM-007-62-1 FAUF)
(CEA-R-3000; EUR-2792.f) CFSTI: HC $3.00/MF $0.65

Collisions of plasma puffs, whose characteristics (density and velocity) were varied in a broad domain are studied in a homogeneous longitudinal magnetic field. It has been verified that the puffs meet head on. We show that collisions of dense ($n_i \geq 4.10^{14}$ cm^{-3}) and relatively slow ($v_o \leq 10^7$ cm.s) puffs are efficient, i.e. the initial kinetic energies of the puffs are converted into thermal energy of the ions in the resulting plasma. Faster and less dense puffs interact little; incomplete conversion of kinetic into thermal energy. The limit between efficient and inefficient collisions corresponds to that which is expected from the test particle model. The slowing down of our puffs is thus ensured mainly by particle–particle interactions. The use of electric probes and the examination of the evolution of the plasma produced by the collision show that this plasma does not exhibit any rapid radial motion. In the magnetic bottle of Bille-en-Tete A (mirror ratio 4000/2000 G), the collision of two low density puffs leads to the capture of one liter of plasma with a density $n_i \simeq 2.10^{13}$ cm^{-3} and an ionic temperature $T_i \simeq 10^6$°C. Author

N67-21059# Kernforschungsanlage, Juelich (West Germany). Institut fuer Plasmaphysik.

MEASUREMENTS OF THE CONTINUUM RADIATION OF A THETA PINCH PLASMA BETWEEN 4000 AND 6000 Å AND BETWEEN 5 AND 20 Å FOR THE PURPOSE OF INVESTIGATING THE HEATING OF ELECTRONS [MESSUNGEN DER KONTINUUMSSTRAHLUNG EINES THETAPINCHPLASMAS ZWISCHEN 4000 UND 6000 Å UND ZWISCHEN 5 UND 20 Å ZUR UNTERSUCHUNG DER AUFHEIZUNG DER ELEKTRONEN]

J. Schlueter Sep. 1966 77 p refs In GERMAN
(JUL-413-PP) CFSTI: HC $3.00/MF $0.65

The plasma for this experiment was created with the help of a theta pinch apparatus and main emphasis was made on measurement of the soft X-rays. In order to investigate the series of mechanisms which are reponsible for the heating of the electrons, the spectral course of the continuum was measured to check whether the speed distribution of the electrons was thermal. The continuum was identified as a hydrogen Bremsstrahlung continuum which in the soft X-ray band decreased exponentially as the frequency increased, resulting in a thermal distribution of the electrons. A Bragg vacuum spectrometer was built for the 1–25 Å band. The most important consideration in its construction was the attainment of adequate freedom from light scatter. A reliable method of testing for light scatter was also developed. Author (ESRO)

N67-21082 Kernforschungsanlage, Juelich (West Germany). Institut fuer Technische Physik.

APPLIED MAGNETOHYDRODYNAMICS. VOLUME I: THEORETICAL FOUNDATIONS [ANGEWANDTE MAGNETOHYDRODYNAMIK. HEFT I: THEORETISCHE GRUNDLAGEN]

T. Bohn and H. A. Claassen Dec. 1963 48 p refs In GERMAN
(JUL-145-TP) CFSTI: $3.00

This report contains a survey on nonrelativistic elementary magnetohydrodynamic equations that includes random problems and dimensionless parameters. Special emphasis is placed on changes to Ohm's law for rarefied ionized gases in strong magnetic fields. Elementary equations are used to describe and analyze physically some characteristic magnetohydrodynamic phenomena. Author

N67-21083# Kernforschungsanlage, Juelich (West Germany). Institut fuer Plasmaphysik.

ON THE FUNCTIONING OF A LINEAR PLASMA ACCELERATOR [UEBER DEN BEWEGUNGSVORGANG IN EINEM LINEAREN PLASMABESCHLEUNIGER]

Armin Kaleck Jul. 1964 63 p refs In GERMAN
(JUL-180-PP) CFSTI: HC$3.00/MF$0.65

The following three models were used to compute the motion dynamics of a linear plasma accelerator: (1) a free particle model; (2) a snowplow model; and (3) a constant mass model. Various interchange processes of plasmas with natural gas were used to determine the friction coefficient for the constant mass model and to obtain the motion equations for subsequent numerical integration. The relationship between dynamic circuit values and dimensions established some qualitative properties independent of the respectively models. Example calculations found a relationship for the optimization of an impulse and the specific impulse. A graphical presentation of the motion dynamics is included. Transl. by G.G.

N67-21093# Kernforschungsanlage, Juelich (West Germany). Institut fuer Plasmaphysik.

PARTICLE ACCELERATION IN TEMPORARY LINEAR VARIABLE AXIAL MAGNETIC FIELDS UNDER THE INFLUENCE OF AN ELECTRIC SPACE CHARGE FIELD [TEILCHENBESCHLEUNIGUNG IN ZEITLICH LINEAR VERAENDERLICHEN AXIALEN MAGNETFELDERN UNTER DER EINWIRKUNG ELEKTRISCHER RAUMLADUNGSFELDER]

H. Kever Mar. 1964 25 p refs In GERMAN
(JUL-157-PP) CFSTI: HC$3.00/MF$0.65

Nonrelativistic equations were used to determine the velocity of charged particles in temporary-linear changeable axial magnetic fields. Results showed that particles, having the same specific charge and a beginning velocity of zero, move independent of their starting radius in the axis of the magnetic field. Example computations establish the motion for an electron by using the two-dimensional flow theory of the shock-free plasma. Transl. by G.G.

N67-21097# Kernforschungsanlage, Juelich (West Germany). Institut fuer Plasmaphysik.

ON THE PARAMETERS OF THE SOLUTIONS OF VLASOV'S EQUATION [UEBER DIE PARAMETRISIERUNG DER LOESUNGEN DER VLASOV-GLEICHUNG]

P. Graeff (Tech. Hochschule Aachen) Nov. 1964 122 p refs In GERMAN
(JUL-203-PP) CFSTI: HC$3.00/MF$0.65

The shock-free Boltzmann–Vlasov equation together with Maxwell equations was used to analyze the dynamic properties of highly ionized plasmas. Considered was the medium effect of all particles for a certain area of the electrical field by substituting the shock-term with a self-consistent approximation on shock effects. Parametrization always led to the momentum problem and its distribution functions; approximation of the distribution function by the Hermetic polynome converges only against weak solutions. Transl. by G.G.

N67-21161* Massachusetts Inst. of Tech., Cambridge. Dept. of Electrical Engineering.

RESEARCH IN ELECTROHYDRODYNAMICS AND TRAVELING-WAVE ELECTROMECHANICAL ENERGY CONVERSION Semiannual Report, 1 Aug. 1966–31 Jan. 1967

James R. Melcher 31 Jan. 1967 16 p refs
(Grant NsG-368)
(NASA-CR-83114) CFSTI: HC$3.00 CSCL 10A

Summary reports are given of research in the field of continuum electromechanics of field-coupled systems, with emphasis on electrohydrodynamics, including such topics as charge relaxation on a moving liquid interface, electrohydrodynamic relaxation surface instabilities, containment of dielectric fluids with rotation, free-charge instability of a dielectrophoretically oriented fluid, thermally induced electrohydrodynamic bulk instability, static field-gradient electroconvection, feedback control of electromechanical systems. Investigations in traveling-wave electromechanical energy conversion are also summarized. L.E.W.

N67-21165*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

HIGH-FREQUENCY WAVES IN A COLLISIONAL PLASMA WITH MAGNETIC FIELD

Bilma Buti 30 Jan. 1967 23 p refs
(NASA-TM-X-59489) CFSTI: HC$3.00/MF$0.65 CSCL 20I

The damping of high-frequency waves, in a hot plasma in an external uniform magnetic field in the presence of weak Coulomb collisions, is investigated by the Fokker–Planck equation. The electron–ion collisions play the dominant role; nevertheless, the electron–electron collisions are important for disturbances of finite wave lengths. As far as the electron–ion–collision contribution is concerned, the frictional term exceeds the diffusion term but in an electron–electron case, both the frictional and the diffusion contributions are of the same order. The two-body Coulomb collisions have a stabilizing effect on these plasma waves; the magnetic field however does not affect the longitudinal waves but has a tendency to stabilize the left-handed polarized wave and to destabilize the right-handed polarized wave. Author

N67-21207# Kernforschungsanlage, Juelich (West Germany). Institut fur Plasmaphysik.

ONE-DIMENSIONAL FIELDS AND ADIABATIC INVARIANCE

Karl Schindler Sep. 1964 81 p refs
(JUL-193-PP) CFSTI: HC$3.00/MF$0.65

The adiabatic invariance properties of the single particle motion are studied for a class of one-dimensional fields. If the fields are sufficiently smooth the theory of the (nonlinear) one-dimensional oscillator applies, which immediately leads to the result that the action integral $J = \oint p\,dq$ is an adiabatic invariant to all orders in ϵ, the reciprocal time scale of the field. Some situations of physical interest, however, require a special treatment because the fields show some lack of smoothness. Two examples are discussed: fields having jump discontinuities, and small scale fields superimposed on a constant magnetic field. In both cases adiabatic invariance of J is established. The results are discussed from several physical points of view as plane collision-free shocks, single particle acceleration, guiding center stability, and adiabatic compression. Author

N67-21208# Kernforschungsanlage, Juelich (West Germany). Institut fur Plasmaphysik.

CALCULATIONS ON THE TEMPERATURE SENSITIVE INTENSITY RATIO OF THE He II-4686 A LINE AND ITS NEIGHBOURING CONTINUUM

H. F. Berg and G. Tondello Aug. 1964 15 p refs

(JUL-182-PP) CFSTI: HC$3.00/MF$0.65

Provided is the calculation of intensity ratio of the He II-4686 A line and its neighboring continuum from 80,000°K to higher temperatures. The present calculation extends the method to lower temperatures, where the continua of both the neutral and ionized atoms have to be considered. In this low temperature domain the temperature sensitivity of the intensity ratio is much increased over that of the high temperature range. The absolute intensities of the continua due to the neutral and ionized atoms are presented separately. Finally the intensity ratio of the He II-4686 A line and its neighboring continuum is plotted and taken out to higher temperatures sufficiently to provide some overlapping points with Griem's calculation. Deviations in the states of the ionized atom from the thermal population were considered. For the partition function cut off the reduced ionization potential from Unsöld's formula was used. Author

N67-21400*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

RECENT PROGRESS WITH THE VORTEX STABILIZED ARC

Stan Neuder, Roberts Urschel, and Roy Mc Intosh (Electro-Mech. Res., Inc., College Park, Md.) Feb. 1967 14 p Prepared jointly with Electro-Mech. Res., Inc., College Park, Md.

(Contract NAS5-9244)

(NASA-TM-X-55725; X-713-67-81) CFSTI: HC$3.00/MF$0.65

Spectroradiometric investigations of vortex stabilized inert gas plasmas continue in order to achieve an improved spectral match. Results of recent measurements on argon, neon, and argon–neon plasmas are presented. A significant step towards the desired spectrum is achieved with certain argon–neon combinations. A description of the vortex arc and associated experimental apparatus is included. Author

N67-21425*# Stanford Research Inst., Menlo Park, Calif.

USE OF THE LANGMUIR PROBE TO DETERMINE THE ELECTRON DENSITY AND TEMPERATURE SURROUNDING RE-ENTRY VEHICLES Final Report

W. E. Scharfman and H. R. Bredfeldt Dec. 1966 102 p refs

(Contract NAS1-4872; SRI Proj. 5771)

(NASA-CR-66275) CFSTI: HC$3.00/MF$0.65 CSCL 20I

The operation of a probe consisting of an electrode wire supported by a wedge-shaped dielectric structure, designed to fly on board the Langley Research Center RAM-C vehicle, was checked by comparison with wire probes and microwave interferometers in an arc-driven shock tube. Measurements were performed over a wide range of electron densities and at initial shock-tube pressures of 0.1 and 1.0 torr. The effect of yaw angle of up to 15° was also checked. The measurements showed that the RAM-C probe could be interpreted in the same manner as a cylindrical-wire probe. A theory was developed for a wedge-shaped electrode structure for operation for which the structure is large compared to the mean-free path. Electron temperature was measured in the shock tube under conditions that were not free-molecular. Good agreement was obtained between the measured electron temperatures and the gas temperature. An experiment was conducted to estimate how the probes would operate in an environment that includes water droplets. The electron density inferred from the probe current was compared to that measured by a microwave interferometer both before and during water-droplet injection into a seeded ethylene–oxygen flame. The relative changes in electron density, as inferred by both techniques, followed each other closely. The probe was not affected by the water droplets. Author

N67-21475# Wisconsin Univ., Madison.

NO TITLE Technical Progress Report, 1 Feb. 1966–31 Jan. 1967

D. M. Meade et al 31 Jan. 1967 10 p refs

(Contract AT(11-1)-1233)

(TID-23454) CFSTI: HC$3.00/MF$0.65

Research progress on plasma anomalous diffusion experiments in toroidal octupole magnetic fields is discussed. Oscillations, techniques, and equipment are briefly discussed. NSA

N67-21480# Oak Ridge National Lab., Tenn.

MAGNETOHYDRODYNAMIC STABILIZATION EXPERIMENTS WITH JET-DRIVEN VORTEX FLOWS

J. J. Keyes, Jr. [1966] 8 p Presented at the Am. Phys. Soc., Fluid Dyn. Div. Ann. Meeting, Stanford, Calif.

(Contract W-7405-ENG-26)

(ORNL-P-2724; CONF-661111-1) CFSTI: HC$3.00/MF$0.65

A review is presented on some experiments in which a study was made of the influence of intense axial magnetic fields on jet-driven vortex flow of an electrolytic conductor. The results of flow visualization studies are emphasized. NSA

N67-21499# California Univ., Livermore. Lawrence Radiation Lab.

ELECTRON INTERACTIONS AND QUANTUM PLASMA PHYSICS

Elizabeth A. Rauscher 28 Sep. 1966 55 p refs

(Contract W-7405-ENG-48)

(UCRL-50148) CFSTI: HC$3.00/MF$0.65

The quantum electrodynamics of the scattering of radiation from a fully ionized, interacting plasma is considered. The plasma particle interaction must properly be treated quantum mechanically when the electron plasma wave phonon energies are comparable to or greater than the mean random electron energies and/or when the phonon momenta are of the order of magnitude or greater than the average electron momenta in the plasma. A calculation of the generalized dielectric constant for both a low-density plasma in the classical limit and a high-density plasma in the quantum mechanical limit is performed and compared in a suitable manner. NSA

N67-21536# Technische Hochschule Hannover (West Germany). Institut fuer Plasmaphysik.

INVESTIGATIONS OF DENSE PLASMAS [UNTERSUCHUNGEN AN DICHTEN PLASMEN]

D. Meiners Bad Godesberg, West Germany, Bundesmin. fuer Wiss. Forschung Jul. 1966 42 p refs In GERMAN; ENGLISH summary

(BMwF-FBK-66-27)

The following problems of plasmas of high particle densities (electron density n_e 10^{18} cm^{-3}) have been studied: (1) experimental investigation of dwell time and reignition phenomena of exploding wires and comparison with the theory of detonation, (2) development of a spark gap for exploding wire experiments at 100 kV, (3) enhancement of shock wave velocity by heating the gas within the driver section of a conventional shock tube by means of a discharge initiated by an exploding wire, and (4) development of a photographical method to determine the absorption coefficient within instationary and inhomogeneous dense plasmas of high optical thickness. Author (NSA)

N67-21548# Gosudarstvennyi Komitet po Ispolzovaniyo Atomnoi Energii, Moscow (USSR). Institut Atomnoi Energii.

THE PHYSICAL INTERPRETATION OF THE MAGNETOHYDRODYNAMIC DESCRIPTION OF PLASMA [O FIZICHESKOI INTERPRETATSII MAGNITOGIDRODINAMICHESKOGO OPISANIYA PLAZMY]

D. A. Frank-Kamenetskii 1966 20 p refs In RUSSIAN
(IAE-1103)

The physical problems connected with the magnetodynamic description of plasma, and the development of a physically justifiable approximation are discussed. Following a brief outline of the single- and multiple-component formulation of plasma hydrodynamics, theoretical discussions are presented on the freedom in coordinate system selection, stationary three-component magnetohydrodynamics, nonstationary multiple-component magnetohydrodynamics, the uniform acceleration approximation, the fictitious forces, and the thermal forces and thermal diffusion. The newly developed approach permits the incorporation of all the forms of drift motion and transport processes. The general structure of the resulting equations agrees with the kinetic theory approximations. In the simple limiting cases (dissipation without collisions) the system of multiple-component magnetohydrodynamics is in fully satisfactory agreement with the results of more complicated kinetic calculations. NSA

N67-21585# Los Alamos Scientific Lab., N. Mex.
ANTICIPATED SCYLLA IV EXPERIMENTS PERTAINING TO SCYLLAC
F. L. Ribe and W. E. Quinn 31 Aug. 1966 17 p refs
(Contract W-7405-ENG-36)
(LA-3596) CFSTI: HC $3.00/MF $0.65

Experiments to be performed on the Scylla IV device which relate to the proposed Scyllac device are described. One group of experiments consists of tests of certain engineering features. A second class of experiments involves studies of plasma stabilization concepts which arise in making a toroidal theta-pinch plasma. These include studies of a "static" bumpy cylindrical plasma, the feasibility of dynamical stabilization techniques, and plasma drift in a curved coil with static stabilization fields. Author (NSA)

N67-21594# United Kingdom Atomic Energy Authority, Culham (England).
ANNULAR PLASMAS PRODUCED BY ROTATING MAGNETIC FIELDS
P. A. Davenport, G. Francis, W. Millar, and A. F. Taylor Aug. 1966 26 p refs
(CLM-R-65) BIS: $0.80/HMSO: 4s

A rotating magnetic field was applied to a cylindrical plasma in a discharge tube whose walls were electrically conducting in the azimuthal direction, which imposed the constraint that the net axial magnetic flux in the tube remained constant. A theoretical analysis of the system predicts that the plasma should be confined in an annular configuration, and this was confirmed experimentally by observations using magnetic probes, an image-converter camera and a laser interferometer. A detailed description of the circuits used to pre-ionize the plasma and to produce the rotating field is included. Author (NSA)

N67-21620# Nagoya Univ. (Japan). Inst. of Plasma Physics.
PROPAGATION OF ION ACOUSTIC SOLITARY WAVES OF SMALL AMPLITUDE
Haruichi Washimi and Tosiya Taniuti Aug. 1966 6 p refs
(IPPJ-51)

It is shown that under certain approximations the basic system of equations governing the propagation of ion-acoustic waves can be reduced to the Kortweg-de Vries equation. Author (NSA)

N67-21677# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems.
VERTICAL MOTION IN THE CENTRAL REGION OF A RELATIVISTIC CYCLOTRON [VERTIKAL'NOE DVIZHENIE IONOV V TSENTRAL'NOI OBLASTI RELYATIVISTSKOGO TSIKLOTRONA]
A. A. Glazov, T. P. Kochkina, D. L. Novikov, and L. M. Onishchenko 1966 19 p refs In RUSSIAN
(JINR-P9-3017-1)

A theoretical analysis of the ion vertical motion in the central region of a relativistic cyclotron is given. The calculation of the motion was performed with an electronic computer; an electric field of the accelerating system was determined by electrolytic tank for the real configuration of the central optics. The motion of two configurations of the beam defining system was calculated. NSA

N67-21720# Nagoya Univ. (Japan). Inst. of Plasma Physics.
SHEET PLASMA MODEL FOR GENERAL PLANE DISTURBANCES
Akira Hasegawa Nov. 1966 27 p refs
(IPPJ-52; AD-645147) CFSTI: HC $3.00/MF $0.65

Sheet plasma model which can be used for studying general plane disturbances in a magnetized plasma is introduced together with some reviews of previous sheet change models. The model may be useful for studying nonlinear effects of general velocity space instabilities propagating with arbitrary angle with respect to a uniform magnetic field. Author (TAB)

N67-21726# Nagoya Univ. (Japan). Inst. of Plasma Physics.
PARTICLE ASPECT ANALYSIS OF DRIFT WAVE INSTABILITY
Y. Terashima Nov. 1966 18 p refs
(IPPJ-53; AD-645148) CFSTI: HC $3.00/MF $0.65

The physical mechanism of drift wave instability is studied from the particle point of view by following the method used by Dawson in his theory of Landau damping. The plasma particles are divided into two groups, resonant particles and non-resonant particles. Assuming that a drift wave starts initially while resonant particles are undisturbed, the trajectories of the particles are computed within the framework of linear theory. Such a drift wave of longitudinal mode is considered that propagates obliquely to a static magnetic field and in the plane normal to density gradient. Author (TAB)

N67-21730# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
INSTABILITY OF THE CURRENT LAYER IN NONHOMOGENEOUSLY MAGNETIZED PLASMA
L. M. Shul'man 24 Aug. 1966 8 p refs Transl. into ENGLISH from Byul. St. Optich. Nablyudeniya Iskusstv. Sputnikov Zemli (USSR), v. 10, 1964 p 70–73
(FTD-TT-66-19; AD-644037) CFSTI: HC $3.00/MF $0.65

The one-dimension problem of plasma stability in the region of a neutral plane was solved. The result shows that on account of the adiabaticity the plasma proves to be unstable. Author (TAB)

N67-21738# Toronto Univ. (Ontario). Inst. for Aerospace Studies
SUPERSONIC FLOW OF INVISCID COMPRESSIBLE PLASMAS WITH A FINITE TENSOR CONDUCTIVITY IN THE PRESENCE OF AN EXTERNAL MAGNETIC FIELD
Lung Yu Shih Dec. 1966 96 p refs
(Grant AF-AFOSR-366-66)
(UTIAS-122; AD-644807) CFSTI: HC $3.00/MF $0.65

A method of determining the macroscopic interaction between the motion of a compressible plasma and electromagnetic fields was developed. The plasma is considered as an electrically conducting fluid with finite conductivity. The viscosity and heat conduction are neglected. The effects of Hall current and ion slip are considered.

Since in general insulated walls may be present to influence the Hall current distribution, charge separation occurs and an electric field is necessary to satisfy the continuity equation for the electric current and the boundary conditions. This electric field was taken into account. The flow under consideration is supersonic and for the practical calculations cases are selected in which a finite expansion around a sharp corner is present. Cases are considered in which the magnetic Reynolds number, although small, cannot be assumed to be zero. The procedure used is based upon a method of successive approximations and is capable of giving solutions for the effect of the induced magnetic field. Numerical computations were made for both two-dimensional and axisymmetric models for cases in which the flow first expands around a sharp corner, then flows through a divergent duct with insulated walls. The applied magnetic field is parallel to the undisturbed upstream flow direction. Author (TAB)

N67-21763# International Centre for Theoretical Physics, Trieste (Italy).

NON-LINEAR INTERACTION OF HELICONS (WHISTLERS) IN INHOMOGENEOUS MEDIA

R. N. Sudan, A. Cavaliere, and M. N. Rosenbluth Jun. 1966 30 p refs Submitted for publication

(IC/66/72) CFSTI: HC $3.00/MF $0.65

The nonlinear interaction of helicons (whistlers) is found to depend radically on whether the plasma has diffuse or sharp boundaries. The conventional picture of three-wave interaction obtained by perturbing the normal mode amplitudes if valid for the diffuse case. However, for a plasma with sharp boundaries, e.g., a solid state plasma including collisions, surface currents play an important role in the limit of large Ω_τ. It is shown that the normal mode method breaks down at even very small amplitudes. A new strong-coupling method is developed which predicts an interaction rate in the large Ω_τ limit that never exceeds the order of the wave linear damping, but should be experimentally observable. Author (ESRO)

N67-21766# Royal Inst. of Tech., Stockholm (Sweden). Div. of Plasma Physics.

MINIMUM TEMPERATURE OF A MAGNETIZED PLASMA

B. Lehnert 30 Dec. 1966 27 p refs

(REPT.-66-19) CFSTI: HC $3.00/MF $0.65

A temperature limit exists below which a fully ionized plasma cannot be sustained within the main part of the confinement volume. The heating power which is needed to sustain the plasma just above this limit will become a measure of the plasma confinement and can be used to investigate the efficiency of magnetic bottles at low plasma temperatures. The theory is applied to a rotating plasma where it is found that the temperature limit corresponds to a limit of the rotation velocity below which the plasma cannot be kept in a fully ionized state. Further application is given to a nonrotating plasma which is sustained by Ohmic heating from an imposed azimuthal current. The current has a lower limit which is a measure of the longitudinal plasma losses at a fixed plasma density and magnetic field strength. Author (ESRO)

N67-21767# International Centre for Theoretical Physics, Trieste (Italy).

A NEW APPROACH TO PLASMA TURBULENCE

A. A. Galeev Jul. 1966 22 p refs Submitted for publication

(IC/66/82) CFSTI: HC $3.00/MF $0.65

An attempt to go beyond the framework of conventional weak turbulence theory is made. A simple dispersion equation for the stability of a steady turbulent state can be found by selective summation of higher-order terms from perturbation theory. The main contribution in the model to be considered here comes from particle motion in the turbulent electric field. In the limit of small wave amplitude, the usual equations of the weakly turbulent plasma can be obtained easily. The theory is applied to the drift-cyclotron instability of a nonuniform plasma to find the steady-state level of drift-cyclotron turbulence. The growth rate of the instability changes essentially at the nonlinear stage, so the usual dimensional arguments to find the turbulent diffusion coefficient cannot be applied using the linear description only. Author (ESRO)

N67-21768# International Centre for Theoretical Physics, Trieste (Italy).

THE EFFECT OF MAGNETIC SHEAR ON PLASMA INSTABILITIES

W. E. Drummond and K. W. Gentle Aug. 1966 15 p refs Sponsored in part by AEC

(IC/66/98) CFSTI: HC $3.00/MF $0.65

A new formulation of the effects of magnetic shear on a plasma is developed. The linearized Vlasov equation is solved in the natural coordinate system that shears with the magnetic field. Instead of an algebraic dispersion relation for waves, a differential equation in k-space results. The solution of this equation must be explored to determine effects of shear on plasma waves. An approximate solution is obtained for the drift-wave instability and the criterion for shear stabilization is calculated. The criterion is close to previous results, but the nature of the stable mode is quite different. Author (ESRO)

N67-21819# California Univ., Livermore. Lawrence Radiation Lab.

INSTABILITIES OF HIGH-TEMPERATURE PLASMAS

Harold P. Furth 8 Aug. 1966 8 p refs Presented at the Ann. Meeting of the German Phys. Soc., Munich

(Contract W-7405-ENG-48)

(UCRL-70049; CONF-661030-1) CFSTI: HC $3.00/MF $0.65

Previously, the only theory capable of dealing with the equilibrium and stability properties of finite-size plasmas was the simple hydromagnetic theory, in which the plasma is described as a perfectly conducting fluid. This theory has the attraction of extending favorable prospects for all sorts of magnetic confinement geometries and heating methods. It also has the merit of substantial correspondence with experimental reality in those cases where it predicts instability. Its main failure is that its predicted situations of stable confinement turn out experimentally to be merely situations of reduced instability. During the past five years, effects arising from the finiteness of the confined plasma have been treated with considerably more theoretical sophistication, and the main classes of residual instability have been analyzed. Experiments conforming with the new and more restrictive stability requirements are under way and appear encouraging. A review of these studies is presented. Author (NSA)

N67-21868# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

MEASUREMENT OF STICKING PROBABILITY AND RECOMBINATION COEFFICIENT OF ELECTRONS IN GASSES BY THE METHOD OF PENETRATING RADIATIONS [IZMERENIOA KOEFFITSIYENTOV PRILIPANIYA I REKOMBINATSII ELEKTRONOV V GAYAKH METODOM PRONIKAYUSHCHIKH IZLUCHENIY]

V. B. Brodskiy and S. Ye. Zegik 24 Aug. 1966 18 p refs Transl. into ENGLISH of the Russian publ.

(FTD-MT-65-545; AD-643957)

A technique and experimental results for measurements of gas pressure dependence of attachment and recombination coefficients for thermalized electrons in air and oxygen are described. Author (TAB)

N67-21873# Naval Research Lab., Washington, D. C.
MAGNETICALLY INDUCED NONEQUILIBRIUM ELECTRON TEMPERATURES Interim Report
Herbert B. Rosenstock 23 Nov. 1966 19 p refs
(NRL-6456; AD-645932)

For operation of an MHD generator at low temperatures, various methods have been proposed to enhance the ionization and hence the conductivity. The report considers the scheme in which the electrons present in an MHD generator are accelerated by the magnetic field itself (to a magnetically included nonequilibrium temperature) preparatory to producing additional electrons by impact ionization. A model for the flow of a partially ionized gas in an MHD generator that combines extreme mathematical simplicity with at least qualitative physical realism is used. The derivations show that the electron temperatures attained cannot exceed the temperature that the gas had before part of its kinetic energy was converted into motion along the channel; that is, the magnetically induced nonequilibrium electron temperature cannot exceed the stagnation temperature of the gas, which is equal to the temperature of the gas at rest before being expanded through a nozzle. Author (TAB)

26 PHYSICS, SOLID-STATE

Includes semiconductor theory, and superconductivity. For applications see: 16 Masers. For related information see also: 10 Electronics.

N67-20441*# Oak Ridge National Lab., Tenn. Thermonuclear Div.
EXPERIMENTAL SIMULATION OF LARGE, HIGH FIELD, SUPERCONDUCTING MAGNET OPERATION Quarterly Report, Jun. 1–Aug. 31, 1966
7 Sep. 1965 42 p refs
(NASA Order H-76798)
(NASA-CR-83124; ORNL-TM-1266; QR-2) CFSTI: HC $3.00/MF $0.65 CSCL 20L

CONTENTS:

1. EXPERIMENTAL SIMULATION OF LARGE, HIGH FIELD, SUPERCONDUCTING MAGNET OPERATION K. R. Efferson, W. F. Gauster, D. L. Coffey, and J. N. Luton, Jr. 24 p refs (See N67-20442 10-26)

2. FIELD DISTRIBUTION IN A HARD SUPERCONDUCTOR WITH ADIABATIC FIELD CHANGE W. F. Gauster and H. A. Ullmaier 12 p refs (See N67-20443 10-26)

N67-20442*# Oak Ridge National Lab., Tenn. Thermonuclear Div.
EXPERIMENTAL SIMULATION OF LARGE, HIGH FIELD, SUPERCONDUCTING MAGNET OPERATION
K. R. Efferson, W. F. Gauster, D. L. Coffey, and J. N. Luton, Jr. *In its* Exptl. Simulation of Large, High Field, Superconducting Magnet Operation 7 Sep. 1966 24 p refs (See N67-20441 10-26) CFSTI: HC $3.00/MF $0.65

Diversified work has been directed toward a more thorough understanding of the complex performance of superconducting coils. Tests with sample coils wound of 0.005-in. copper clad Nb–25% Zr wire showed very different results from those made previously with 0.010-in. wire coils. The 0.005-in. Nb–25% Zr wire was used for short sample stabilization experiments which will be continued in order to clarify several newly observed phenomena. A comparison calculation between stabilized coils and conventional superconducting coils has been made. Micro Hall Probe measurements have been performed on Nb–Zr cylinders and sample coils. Author

N67-20443*# Oak Ridge National Lab., Tenn. Thermonuclear Div.
FIELD DISTRIBUTION IN A HARD SUPERCONDUCTOR WITH ADIABATIC FIELD CHANGE, APPENDIX A
W. F. Gauster and H. A. Ullmaier *In its* Exptl. Simulation of Large, High Field, Superconducting Magnet Operation 7 Sep. 1966 12 p refs Sponsored by AEC (See N67-20441 10-26) CFSTI: HC $3.00/MF $0.65

A hard superconducting semi-infinite slab with zero initial conditions is considered, and a step by step calculation method is given for determining the distributions of the flux density B, temperature T, and shielding current density J. This calculation procedure shows that for the case of a semi-infinite slab the distributions of B, T, and J inside the wave move along with the wave. A procedure for writing a computer code, based on the derived equations, is mentioned. A numerical integration method similar to the one described for the semi-infinite slab is described for determining field distributions in cylinders. L.E.W.

N67-20448# McGill Univ., Montreal (Quebec). Eaton Electronics Research Lab.
ABSORPTION SPECTRA OF MnF_2 AND $C_sM_nF_3$
Richard Stevenson Oct. 1966 15 p refs Sponsored in part by Natl. Res. Council of Canada
(Contract Nonr-3013(00))
TR-6; AD-641917) CFSTI: HC $3.00/MF $0.65

Absorption spectra in the 3950A region of MnF2 and CsMnF3 at 4.2K are presented. The spectra show transitions from the sextuplet-gamma-1 ground state to the quadruplet-gamma-1 and quadruplet-gamma-3 excited states. Remarkable similarity in the spectra is observed, suggesting that magnetic interactions in both crystals are very similar. The sextuplet-gamma-1 to quandruplet-gamma-3 transitions appear to be the same both in the sigma and the P1 spectra. Fine structure is found on the sextuplet-gamma-1 to quadruplet-gamma-1 transitions. In the P1-spectra the fine structure seems to show a Lande interval pattern, and is interpreted in terms of a K.S1.S2 interaction (S = 3/2) with K = 16.7/cm for MnF2 and 16.8/cm for CsMnF3 in the sigma-spectrum exchange coupling of ion pairs is observed. The pair is excited so that one ion gives into the S = 3/2 state, while the other remains in the S = 5/2 state. The selection rule is that the total spin of the pair is constant. Author (TAB)

N67-20462# IIT Research Inst., Chicago, Ill. Technology Center.
OPTICAL AND LUMINESCENCE PROPERTIES OF MATERIALS UNDER HIGH PRESSURE Final Scientific Report, 1 May–30 Apr. 1966
S. S. Mitra 30 Nov. 1966 158 p refs
(Contract AF 19(628)-5144)
(IITRI-A6138; AFCRL-66-615; AD-644019) CFSTI: HC $3.00/MF $0.65

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1. OPTICAL AND LUMINESCENT PROPERTIES OF MATERIALS UNDER HIGH PRESSURE p 1–2

2. LATTICE VIBRATIONAL PROPERTIES OF HEXAGONAL CdSe R. Geick, C. H. Perry (MIT), and S. S. Mitra p 3–6 refs (See N67-20463 10-26)

3. LATTICE INFRARED SPECTRA OF BORON NITRIDE AND BORON MONO-PHOSPHIDE P. J. Gielisse, R. C. Griffis (GE), S. S. Mitra (Rhode Island Univ.), L. C. Mansur (AFCRL), J. N. Plendl et al p 7–41 refs (See N67-20464 10-26)

4. THE INFRARED AND RAMAN-ACTIVE LATTICE VIBRATIONS IN ZnSe S. S. Mitra (R. I. Univ.), E. Carnall, Jr. (Eastman Kodak Co.), N. T. Mc Devitt (Wright-Patterson AFB), and R. Marshall p 42–62 refs (See N67-20465 10-26)

5. TEMPERATURE DEPENDENCE OF INFRARED DISPERSION IN IONIC CRYSTALS LiF AND MgO J. R. Jasperse, A. Kahan, J. N. Plendl, and S. S. Mitra (AFCRL) p 63–79 refs (See N67-20466 10-26)

6. THE FAR INFRARED SPECTRA OF SOLIDS UNDER HIGH PRESSURE (33–100 μ) J. R. Ferraro, S. S. Mitra, and C. Postmus (Argonne Natl. Lab.) p 80–89 refs (See N67-20467 10-26)

7. COMPRESSIBILITY, COHESIVE ENERGY, AND HARDNESS OF NON-METALLIC SOLIDS J. N. Plendl, S. S. Mitra (AFCRL), and P. J. Gielisse (GE) p 9–97 refs (See N67-20468 10-26)

8. U CENTERS IN CsBr S. S. Mitra and Y. Brada p 98–99 refs (See N67-20469 10-26)

9. ELECTRONIC STRUCTURE OF THE U CENTER N. N. Spector, S. S. Mitra, and N. N. Schmeising p 100–139 refs (See N67-20470 10-26)

10. LOCAL-MODE RESONANCE—AN OPTICAL ANALOG OF MOSSBAUER EFFECT S. S. Mitra and R. S. Singh p 140–142 refs (See N67-20471 10-26)

N67-20463 IIT Research Inst., Chicago, Ill. Physics Research Div.

LATTICE VIBRATIONAL PROPERTIES OF HEXAGONAL CdSe

R. Geick, C. H. Perry (MIT) and S. S. Mitra *In its* Opt. and Luminescence Properties of Mater. Under High Pressure 30 Nov. 1966 p 3–6 refs Repr. from J. Appl. Phys., v. 37, no. 5, Apr. 1966 p 1994–1997 Presented at spring meeting of the Am. Phys. Soc., Kansas City, Mar. 1965 (See N67-20462 10-26) CFSTI: $3.00

The reflectivity of single-crystalline CdSe was studied with linearly polarized light at room temperature and at liquid-nitrogen temperature. The characteristic data of the fundamental lattice vibration were determined by means of a classical oscillator fit. A shift of 6 cm^{-1} or 3.5% in the infrared eigenfrequency was found, due to anisotropy splitting. Transmission measurements yielded several multiphonon peaks and an impurity band. The multiphonon peaks are interpreted in terms of a set of four representative phonon energies for the edge of the Brillouin zone. Author

N67-20464# IIT Research Inst., Chicago, Ill.

LATTICE INFRARED SPECTRA OF BORON NITRIDE AND BORON MONO-PHOSPHIDE

P. J. Gielisse, E. A. Pascoe (GE Co., Detroit), J. N. Plendl, L. C. Mansur (AFCRL), R. Marshall et al *In its* Opt. and Luminescence Properties of Mater. Under High Pressure 30 Nov. 1966 p 7–41 refs (See N67-20462 10-26) CFSTI: HC $3.00/MF $0.65

The fabrication of highly dense polished compacts consolidated from mono-crystalline cubic boron nitride at very high pressures and temperatures has enabled us to record the infrared reflection spectrum of cubic boron nitride from 80° to 550°K. For annealed compacts the reststrahlen peak reflectivity of about 85% could be obtained. Analysis of data by a damped oscillator model yields: TO ($k \approx 0$) = 1965 cm^{-1}, $\epsilon_0 = 7.1$, $\epsilon_\infty = 4.5$ and LO ($k \approx 0$) = 1340 cm^{-1}. Infrared transmission on small single crystals was measured with a beam condenser. Eleven absorption peaks were observed between 600 and 3000 cm^{-1}. These ar assigned as combinations of four Brillouin zone boundary modes: LO = 1232 cm^{-1}, TO = 1000 cm^{-1}, LA = 885 cm^{-1} and TA = 348 cm^{-1}. The reflection spectrum of hot pressed compacts of boron monophosphide single crystals measured between 600 and 1000 cm^{-1} showed a monotonic decrease of reflectivity from about 15% to 9% with an extremely weak reststrahlen band around 825 cm^{-1}. The estimated values of long wavelength optical modes are TO ($k \approx 0$) = 820 cm and LO ($k \approx 0$) = 835 cm^{-1}. The results suggest an extremely low effective ionic charge for the crystal. Author

N67-20465 IIT Research Inst., Chicago, Ill.

THE INFRARED AND RAMAN-ACTIVE LATTICE VIBRATIONS IN ZnSe

S. S. Mitra (R. I. Univ.), N. T. McDevitt (Wright-Patterson AFB), E. Carnall, Jr. (Eastman Kodak Co.), and R. Marshall *In its* Opt. and Luminescence Properties of Mater. Under High Pressure 30 Nov. 1966 p 42–62 refs Presented at Meeting of Am. Phys. Soc., Chicago, Oct. 1965 Submitted for publication (See N67-20462 10-26)

(Contract AF 14(628)-2418) CFSTI: $3.00

The infrared reflection, transmission and the Raman spectra of ZnSe are reported in the region of 70 to 1200 cm^{-1}. The data are analyzed to obtain the critical point phonon frequencies (in cm^{-1}). Author

N67-20466 IIT Research Inst., Chicago, Ill. Physics Research Div.

TEMPERATURE DEPENDENCE OF INFRARED DISPERSION IN IONIC CRYSTALS LiF AND MgO

J. R. Jasperse, A. Kahan, J. N. Plendl (AFCRL) and S. S. Mitra *In its* Opt. and Luminescence Properties of Mater. Under High Pressure 30 Nov. 1966 p 63–79 refs Repr. from Phys. Rev., v. 146, no. 2, 10 Jun. 1966 p 526–542 (See N67-20462 10-26) CFSTI: $3.00

Infrared-reflectivity measurements were made from 200 to 800 cm^{-1} at temperatures ranging from 7.5° to 1060°K for LiF and from 8° to 1950°K for MgO. The reflection spectra were analyzed by means of a two-resonance damped-oscillator model, and the calculated optical properties are presented. Dielectric dispersion theory is reviewed and it is shown that all the major theories discussed give identical results for the susceptibility when evaluated at the reststrahlen frequency but differ from one another at other frequencies. The damping constant γ for LiF and MgO in the high-temperature limit ($\hbar\nu_1 < kT$) agrees reasonably well with the formula suggested by Maradudin and Wallis, but discrepancies seem to appear in the low-temperature limit ($\hbar\nu_1 < kT$). The general behavior of the extinction coefficient in the wings of the absorption region is consistent with the notion of continuous absorption produced by multiphonon processes. The shift of the long-wavelength optical-mode frequencies of LiF, MgO, and RbI with temperature is discussed in terms of the volume and other anharmonic effects. The anharmonic part of the frequency shift is found to agree qualitatively with the theory of Maradudin and Fein. Author

N67-20467# Argonne National Lab., Ill.

THE FAR INFRARED SPECTRA OF SOLIDS UNDER HIGH PRESSURE (33–100 μ)

J. R. Ferraro, S. S. Mitra, and C. Postmus *In* IIT Res. Inst. Opt. and Luminescence Properties of Mater. Under High Pressure 30 Nov. 1966 p 30–89 refs Presented at 5th Natl. Meeting of the Soc. for Appl. Spectry., Chicago, 13–17 Jun. 1966 Supported in part by AEC and AF (See N67-20462 10-26) CFSTI: HC $3.00/MF $0.65

A Perkin–Elmer spectrophotometer, a modified beam condenser, and a high pressure diamond cell were used to extend the infrared region of solids to 100 microns. Details of the method used and the results obtained are discussed. Preliminary results indicated only small minor shifts for internal modes of vibrations, while large shifts were observed for external modes (lattice vibrations). This method can thus possibly be a way of distinguishing between the two modes and would simplify the interpretation of the far infrared spectra of solids. Extension of high pressure studies to the infrared

region of 100 cm^{-1}, aside from a study of lattice vibrations, makes possible studies of the low lying hydrogen bonded vibrations in hydrogen bonded systems. Other solid state effect in the low energy regions also may be studied under high pressure. R.N.A.

N67-20468# IIT Research Inst., Chicago, Ill.
COMPRESSIBILITY, COHESIVE ENERGY, AND HARDNESS OF NON-METALLIC SOLIDS
J. N. Plendl (AFCRL), P. J. Gielisse (GE Co., Detroit), and S. S. Mitra *In its* Opt. and Luminescence Properties of Mater. Under High Pressure 30 Nov. 1966 p 90–97 refs Repr. from Phys. Stat. Sol., v. 12, 1964 p 367–374 refs (See N67-20462 10-26) CFSTI: HC $3.00/MF $0.65

A new formulation which relates compressibility with cohesive energy and molecular volume for dielectric solids, is given. The relation has been confirmed with forty-five crystalline compounds (binaries and ternaries) representing nine different structures. An atomistic expression of compressibility is developed and its bearing on various methods of hardness testing is reviewed. Author

N67-20469# IIT Research Inst., Chicago, Ill. Physics Div.
U CENTERS IN CsBr
S. S. Mitra and Y. Brada *In its* Opt. and Luminescence Properties of Mater. Under High Pressure 30 Nov. 1966 p 98–99 refs Repr. from Phys. Rev., v. 145, no. 2, 13 May 1966 p 145–146 refs (See N67-20462 10-26) CFSTI: HC $3.00/MF $0.65
(Contract AF 19(628)-2418)

The formation and optical properties of *U* centers (H^- ions at vacant halogen sites) in CsBr is reported. The infrared absorption spectrum due to the localized vibrational mode of this center has been studied between 80° and 300°K. At 80°K, the local-mode resonance occurs at 363 cm^{-1}. The first electronic transition of the center (*U* band) has been studied between 6° and 360°K. At 6°K the U-band position is measured at 5.11 eV, and its limiting half-width is 0.26 eV. The effective phonon frequency contributing to the width has a value of 95 cm^{-1} Author

N67-20470# IIT Research Inst., Chicago, Ill.
ELECTRONIC STRUCTURE OF THE U CENTER
H. N. Spector, S. S. Mitra, and H. N. Schmeising *In its* Opt. and Luminescence Properties of Mater. Under High Pressure 30 Nov. 1966 p 100–139 refs (See N67-20462 10-26) CFSTI: HC $3.00/MF $0.65

Wave functions and energy levels for the triplet and higher excited singlet states of the U center are calculated using the point ion model of Gourary. The transition energy and oscillator strengths are computed. The calculations of Gourary for the first singlet transition are extended to include all the alkali halides for which experimental information is available including those having the CsCl and NaCl structures. The theoretical calculations for the first singlet transition are approximately 15% smaller than the experimental values. The oscillator strengths computed for this transition agree with those of Gourary. The theoretical calculations for the first triplet transition predict that it will lie in the visible and near infrared region of the spectra. The oscillator strength calculated for this transition is less than for the singlet transition. The theoretical values of the transition energies and oscillator strengths for the second singlet and triplet transitions are also calculated. Author

N67-20471# IIT Research Inst., Chicago, Ill. Physics Research Div.
LOCAL-MODE RESONANCE—AN OPTICAL ANALOG OF MÖSSBAUER EFFECT
S. S. Mitra and R. S. Singh *In its* Opt. and Luminescence Properties of Mater. under High Pressure 30 Nov. 1966 p 140–142 refs Repr. from Phys. Re. Letters, v. 16, no. 16, 18 Apr. 1966 refs (See N67-20462 10-26) CFSTI: HC $3.00/MF $0.65

The theory of Mössbauer effect is applied to the resonance absorption of light by impurity-induced local modes. The resonance treated as modulation of the local mode by the host-lattice phonons predicts the temperature dependence of peak position, half-width, and intensity of the absorption. Author

N67-20494# Hughes Research Labs., Malibu, Calif.
CONDENSATION AND NUCLEATION PROCESSES OF SINGLE CRYSTAL THIN FILMS Summary Technical Report, 1 Jul. 1965–30 Jun. 1966
Ryoichi Kikuchi, Alfred F. Kaspaul, and Morris Braunstein Wright-Patterson AFB, Ohio. AF Materials Lab., Oct. 1966 213 p refs
(Contract AF 33(615)-2869)
(AFML-TR-66-326; AD-644697) CFSTI: HC $3.00/MF $0.65

CONTENTS:

1. INTRODUCTION AND SUMMARY 130 p refs (See N67-20495 10-26)
2. DERIVATION OF THE CLUSTER GROWTH EQUATIONS USING THE PATH PROBABILITY METHOD R. Kikuchi 18 p refs (See N67-20496 10-26)
3. THEORY OF NUCLEATION AND GROWTH OF A THIN FILM. I: EQUILIBRIUM TWO-DIMENSIONAL LIQUID-GAS PHASES R. Kikuchi 24 p refs (See N67-20497 10-26)
4. THEORY OF NUCLEATION AND GROWTH OF A THIN FILM. II: APPLICATION OF THE PATH PROBABILITY METHOD R. Kikuchi 45 p refs (See N67-20498 10-26)

N67-20495# Hughes Research Labs., Malibu, Calif.
INTRODUCTION AND SUMMARY
In its Condensation and Nucleation Processes of Single Crystal Thin Films Oct. 1966 130 p refs (See N67-20494 10-26) CFSTI: HC $3.00/MF $0.65

Theoretical and experimental research on the condensation and nucleation processes controlling the formation of single-crystal thin films on crystalline and amorphous dielectric substrates is reported. A theoretical technique called the path probability method of irreversible cooperative processes was used to derive a set of kinetic differential equations to describe nucleation and film growth. The moving mask experiment, which grows a silicon film by vapor deposition, is considered to be able to produce better single crystal films than those produced by existing methods. Using thermal dissociation of silane on a sapphire substrate, the influence of predeposited foreign atoms on nucleation and film growth was studied. Experimental results, in general agreement with the results of the theoretical study, indicate that the predeposited nickel, chrome, and Nichrome-V alloy enhance nucleation of silicon. R.U.

N67-20496# Hughes Research Labs., Malibu, Calif.
DERIVATION OF THE CLUSTER GROWTH EQUATIONS USING THE PATH PROBABILITY METHOD
Ryoichi Kikuchi *In its* Condensation and Nucleation Processes of Single Crystal Thin Films Oct. 1966 18 p refs (See N67-20494 10-26) CFSTI: HC $3.00/MF $0.65

In order to clarify the nature of the nucleation phenomenon, especially its fluctuation aspect, the kinetic differential equations for the cluster growth are examined. When the path probability method is used in deriving these equations for condensation from a gas system, it is found that these equations represent the most

probable change of state (called the natural path). This derivation is consistent with the equation of state which has a horizontal line for the gas-liquid phase change rather than the van der Waals loop. Two main conclusions are derived: (1) The natural path of the path probability method is sufficient for deriving equations for nucleation and crystal growth, and the anticausal path for fluctuation is not needed. (2) The van der Waals type equation of state is approximate, and special precautions must be taken when it is used in connection with kinetic processes. Author

N67-20487# Hughes Research Labs., Malibu, Calif.
THEORY OF NUCLEATION AND GROWTH OF A THIN FILM. I: EQUILIBRIUM TWO-DIMENSIONAL LIQUID-GAS PHASES
Ryoichi Kikuchi *In its* Condensation and Nucleation Processes of Single Crystal Thin Films Oct. 1966 24 p refs (See N67-20494 10-26) CFSTI: HC $3.00/MF $0.65

As a preparation for the study of nucleation and growth of a film, the equation of state is derived for a system of atoms on a two-dimensional lattice using the cluster variation method. Two cases are calculated. In the first portion of the paper the pair approximation is used for the case in which fixed impurities are scattered on the lattice. The isotherm is of the van der Waals type. In the second portion of the paper, a triangle is used as the basic cluster to show how the improved approximation works. It is significant that a flat portion in the pressure-density isotherm results in connection with the phase separation. Author

N67-20498# Hughes Research Labs., Malibu, Calif.
THEORY OF NUCLEATION AND GROWTH OF A THIN FILM. II: APPLICATION OF THE PATH PROBABILITY METHOD
Ryoichi Kikuchi *In its* Condensation and Nucleation Processes of Single Crystal Thin Films Oct. 1966 45 p refs (See N67-20494 10-26) CFSTI: HC $3.00/MF $0.65

Nucleation and growth of a thin film on a substrate by vapor deposition are studied theoretically using a statistical mechanical technique called the path probability method for irreversible cooperative phenomena. Kinetic differential equations for three variables which specify the state of the film are derived as the most probable path. The limit of the stationary state leads to the gas-liquid isotherm identical to the one derived from the equilibrium theory, showing the internal consistency of the treatment. The process of film growth is calculated by integrating the kinetic equations for given pertinent parameters such as the rate of impinging atoms, density of impurities and the activation energies for migration and evaporation. Under certain parameters the density of the film stays on the first plateau value for some time before it increases suddenly to the second plateau. The first plateau is identified as the critical state of nucleation. The size of the critical nuclei is deduced; when the impurity density is larger, the film can grow with smaller rate of impingement and hence the critical size is larger. Author

N67-20520# Polytechnic Inst. of Brooklyn, N. Y. Electrophysics Group.
GALVANOMAGNETIC INTERACTIONS IN FERROMAGNETIC RESONANCE
L. M. Silber and H. M. Stark 27 May 1966 9 p refs
(Contract AF 49(638)-1402; Grant NSF GP-753)
(PIBMRI-1337-66; AFOSR-66-2355; AD-641143) CFSTI: HC $3.00/MF $0.65

A new method has been developed for studying the galvanomagnetic as well as the magnetic properties of ferromagnetic materials. The method has been applied to thin films of nickel and permalloy and has yielded results for the conductivity, magnetoresistance anisotropy, extraordinary Hall coefficient, saturation magnetization, and magnetic relaxation time in these materials at microwave frequencies. The new method consists of measuring the second harmonic signal generated by galvanomagnetic interactions when an electromagnetic wave is incident on a magnetized conducting ferromagnetic film. In a ferromagnetic material, the relationship between current density and the applied electric fields takes the usual form of Ohms Law with second and third term is due to galvanomagnetic effects. The measurement of the microwave galvanomagnetic properties of ferromagnetic materials by the second harmonic method has an advantage over the measurement of the dc signal in that two measurements can be made - the magnitude and phase of the galvanomagnetically-induced signal. The process of extracting the material parameters from the measured data is thus greatly simplified. In addition, the method has been shown to be a sensitive probe of the state of magnetization in thin films. It can be extended to study in greater detail films with special variations in magnetization, as in standing spin waves, non-linearities in the magnetization at high powers, as well as galvanomagnetic effects in magnetic semiconductors or paramagnetics. Author (TAB)

N67-20543# Lincoln Lab., Mass. Inst. of Tech., Lexington.
SOLID STATE RESEARCH Quarterly Technical Summary, 1 May–31 Jul. 1966
Alan L. McWhorter Oct. 1966 68 p refs
(Contract AF 19(628)-5167)
(Rept.-1966-3; ESD-TR-66-403; AD-641498) CFSTI: HC $3.00/MF $0.65

This report covers in detail the solid state research work at Lincoln Laboratory for the period 1 May through 31 July 1966. The topics covered are Solid State Device Research, Optical Techniques and Devices, Materials Research, and Physics of Solids. Author (TAB)

N67-20551# Army Electronics Labs., Fort Monmouth, N. J.
HIGHER ORDER ELASTIC COEFFICIENTS FOR CRYSTALS; THE THIRD-ORDER ELASTIC STIFFNESSES
Rudolf Bechmann Aug. 1966 23 p refs
(ECOM-2766; AD-642844) CFSTI: HC $3.00/MF $0.65

The third-order elastic coefficients of crystals are defined in different manners in the literature resulting in different numerical values for the same coefficients. The derivations of three definitions of the third-order elastic stiffnesses are considered in the first section of this report while simplifications for the third-order stiffnesses for the various crystal classes are given in the second section. Author (TAB)

N67-20564# Massachusetts Inst. of Tech., Cambridge. Center for Materials Science and Engineering.
NO TITLE Annual Technical Report, 16 Sep. 1965–15 Sep. 1966
1 Nov. 1966 158 p refs
(Contract ARPA SD-90)
(AD-642096) CFSTI: HC $3.00/MF $0.65

Contents include: Radiofrequency, microwave and optical spectroscopy of liquids and solids; Low-temperature physics; Semiconductors and infrared spectroscopy; Order-disorder phenomena; Crystal and surface structure investigations of metals, zeolites, and other substances by x-ray, neutron and electron diffraction; Materials theory group - electric, magnetic and optical properties of materials; Semiconductor materials and devices; Properties of compound semiconductors; Solid state energy conversion processes; Semiconductor device research; Microwave

and quantum magnetics; Crystal physics laboratory; Magnetic properties of transition metal oxides; Physics of solids; High temperature metallurgy; Electronic materials; Superconductive materials; Stability of metallurgical structures; Transformations and defects in iron alloys; Radiation damage in solids and nucleation in nozzles; Crystallization and properties of polymers at high pressure; Strain rate effects in alpha iron single crystals; Casting and solidification; X-ray and electron optics laboratory. TAB

N67-20579# Massachusetts Inst. of Tech., Cambridge. Electrical Engineering Dept.

THE KNIGHT SHIFT IN LEAD TELLURIDE VIA RELATIVISTIC APW FUNCTIONS

Paul T. Bailey 22 Aug. 1966 138 p refs

(Contract Nonr-1841-(72))

(TR-4; AD-642519) CFSTI: HC $3.00/MF $0.65

The 82Pb207 nucleus was used, via the measured Knight Shift, to test the accuracy of the relativistic APW calculations for the energy bands of PbTe. Possible Knight Shift contributions other than the contact type are considered and shown to be negligible; the confusion between the Knight Shift and the chemical shift is discussed. The standard formula for the contact Knight Shift in a semiconductor is examined, and is found to be based on the assumption, for a powder specimen, of an isotropic g-factor. It is shown that the large anisotropy of the g-factor in PbTe leads to a correction factor of 4. From the relativistic APW results a value is obtained for the s-character, and also a value for the ionicity. This latter is used, together with relativistic and finite nucleus corrections important for hyperfine interactions involving heavy nuclei, to obtain a value for the hyperfine constant, using the Goudsmit-Fermi-Segre formula. When the calculated s-character, hyperfine constant and anisotropy correction factor are employed with the average experimental value of the g-factor, a Knight Shift value is obtained which is about half the experimental value. Taking into consideration the lack of self-consistency of the relativistic APW calculations, and allowing for the possibility that the experimental values for the g-factor are too small, the APW results are felt to provide a good basis for the explanation of the Knight Shift. Author (TAB)

N67-20603# California Univ., Los Angeles. Dept. of Physics.

ULTRASONIC AND THERMAL EFFECTS IN SUPERCONDUCTORS

Reynold S. Kagiwada Dec. 1966 148 p refs

(Contract Nonr-233(48))

(TR-26; AD-644182) CFSTI: HC $3.00/MF $0.65

Some of the properties of three transition metals, niobium, vanadium, and tantalum, were investigated using the ultrasonic technique. The normal attenuation in niobium possessed a typical electron-phonon behavior with a temperature dependence of T to the -3.2 power. In the superconducting state, attenuation was measured in both the absence of a magnetic field and at various values of the external magnetic field. From the ratio of superconducting to normal conducting attenuation, the zero-degree energy gaps of niobium, vanadium, and tantalum were determined. For niobium, an energy gap of 2 delta (0) = 3.64 plus or minus 0.05 kT sub c was found for the 100 direction of propagation, and an energy gap of 3.70 plus or minus 0.06 kT sub c for the 111 direction. These measurements indicate an anisotropy of the energy gap. The zero-degree energy gap for vanadium was 2 delta (0) = 3.40 plus or minus 0.07 kT sub c in the 110 direction, and 3.10 plus or minus 0.07 kT sub c for tantalum in the 100 direction. Author (TAB)

N67-20604# Purdue Univ., Lafayette, Ind. Dept. of Physics.

SEMICONDUCTOR RESEARCH Semiannual Report, 1 Apr.-30 Sep. 1966

H. Y. Fan et al 30 Sep. 1966 45 p refs

(Contract DA-31-124-ARO(D)-17)

(PRF-3324; AD-643175) CFSTI: HC $3.00/MF $0.65

Contents: Acoustoelectric domain effects in III-V semiconductors; Low temperature transport effects in n-type GaSb at high magnetic fields; Transport measurements at moderate hydrostatic stresses, low temperatures and large magnetic fields; Ultrasonic attenuation in semiconductors; Optical properties of ZnTe; Donor excitation spectrum in n-type aluminum antimonide; Exciton spectra of group III acceptors in silicon; Electron paramagnetic resonance in silicon; The physical and electrical properties of single-crystal tellurium; Low temperature specific heat of reduced TiO2 (rutile); Phonon scattering by neutral donors in Ge at low temperatures. TAB

N67-20606# Royal Inst. of Tech., Stockholm (Sweden). Microwave Dept.

MOBILITY AND TEMPERATURE OF ELECTRONS IN POLAR SEMICONDUCTORS

Kjell Bloetekjaer 15 Sep. 1966 36 p refs

(Contract AF 61(052)-895)

(SR-8; RADC-TR-66-795; AD-643377) CFSTI: HC $3.00/MF $0.65

The transport of electrons due to an electric field in a polar semiconductor is treated with the assumption of a displaced Maxwellian velocity distribution. It is assumed that the only scattering is from optical phonons. Exact expressions are obtained for the drift velocity and the electron temperature. At low lattice temperatures they are substantially different from earlier, approximate results. In particular, if the lattice temperature is less than 0.375 theta, where theta is the characteristic temperature of the optical phonons, the electron temperature is reduced when a weak electric field is applied. For higher field strengths the electron temperature is higher than the lattice temperature, but considerably below that predicted by the approximate theory. Author (TAB)

N67-20630# Illinois Univ., Urbana.

THE BOGOLIUBOV EQUATIONS AND THEIR APPLICATION TO A NORMAL-SUPERCONDUCTING BOUNDARY

Wesley Northey Mathews, Jr. (Ph.D. Thesis) 1966 212 p refs

(Contract DA-31-124-ARO(D)114; Grant NSF-GP-700)

(AD-644028) CFSTI: HC $3.00/MF $0.65

The Bogoliubov equations are used to investigate the pair potential and the electronic excitations associated with a normal-superconducting boundary in an extreme type I superconductor. Author (TAB)

N67-20642# Northrop Corp., Newbury Park, Calif. Applied Research Dept.

RADIATION AND EFFECTS IN SILICON AND GERMANIUM Final Report

O. L. Curtis, Jr., R. F. Bass, and C. A. Germano Washington, HDL, Nov. 1966 155 p refs

(Contract DA-49-186-AMC-235(X))

(ARD/66-56R; Rept.-235-2; AD-643268) CFSTI: HC $3.00/MF $0.65

Measurements indicate that oxygen concentration does not affect lifetime degradation in neutron-irradiated silicon. Type and amount of dopant is also unimportant in n-type material and plays only a limited role in p-type silicon with resistivities less than approximately 5 ohm-cm. The dependence of lifetime on both carrier concentration and temperature indicates that simple recombination theory is not followed; alternate possibilities for explaining the results are proposed. Carrier concentration and mobility

in neutron-irradiated silicon are more seriously affected by oxygen, dopant, and possibly other factors, especially in n-type material. The dominance of the 'disordered region' in recombination is indicated in several ways, including behavior of short-term annealing. Measurement of the dependence of lifetime on injection level has proved very effective in obtaining recombination level parameters. The dominant recombination level at low excitation in both neutron- and gamma-irradiated germanium has been found to be $E_R - E_V = 0.34$ eV with almost no dependence on dopant. Evidently the effective energy level position of the recombination center is unaffected by the disordered region. A second level at $E_C - E_R$ approximately 0.2 eV is required to explain the dependence of lifetime on injection level at high excitation. Comparison with measurements of the temperature dependence of lifetime indicates a temperature variable. Author (TAB)

N67-20652# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

THE EFFECT OF ADSORPTION OF GASES AND VAPORS ON THE WORK FUNCTION OF SEMICONDUCTORS WITH THE STRUCTURE OF ZINC BLENDE

I. A. Kirovskaya, I. S. Sazonova, and L. G. Maydanovskaya 28 Sep. 1966 13 p refs Transl. into ENGLISH from Tr. Sibirsk. Fiz.-Tekhn. Inst. pri Tomsk. Gos. Univ. (Tomsk), v. 43, 1964 p 380–387

(FTD-HT-66-480; TT-67-60269; AD-643971) CFSTI: HC $3.00/MF $0.65

The work function of an electron from germanium (n-type), Gallium arsenide (n-type) and copper bromide was studied in oxygen, hydrogen, propylene and vapors of isopropyl alcohol at different temperatures. A connection was revealed between the n-type state of the surface of these semiconductors and their adsorption capability with respect to oxygen. Author (TAB)

N67-20668# Atomics International, Canoga Park, Calif.

COMPUTER INVESTIGATION OF RADIATION DAMAGE IN CRYSTALS Final Report, Jun. 1965–Aug. 1966

Allan Anderman Sep. 1966 100 p refs

(Contract AF 19(628)-5120)

(A1-66-252; AFCRL-66-688; AD-643956) CFSTI: HC $3.00/MF $0.65

A theoretical study of radiation damage in crystals has been performed, using computer techniques. The materials studied were three face-centered cubic metals: copper, aluminum and gold. Two major areas of investigation were pursued: (1) the study of various static configurations of lattice defects in copper and aluminum; and (2) the study of threshold displacement energies in gold. The major focus of all work done was the effect of the choice of interatomic potential on the calculational results obtained. It is shown that the magnitude of the interstitial defect energies calculated is highly sensitive to the detailed form of the potential employed. With respect to vacancy characteristics, a potential for copper has been developed which leads to excellent agreement with experiment. In addition, a procedure is indicated for modifying this potential to also give meaningful results for interstitial characteristics. Of four Born-Mayer potentials studied for gold, it is shown that only the one derived on the basis of radiation damage data leads to good agreement with experiment for the (100) threshold energy. Threshold studies in the (110) direction indicated highly efficient propagation of energy along the collision line. However, it is concluded that no reasonable judgment concerning the (110) threshold energy can be made from the data obtained. TAB

N67-20718# California Univ., San Diego. Depart. of Physics.

SUPERCONDUCTIVITY IN ONE AND TWO DIMENSIONS. II: CHARGED SYSTEMS

T. M. Rice 9 Aug. 1966 44 p refs

(Contract Nonr-2216-(11); Grant AF-AFOSR-610-64)

(TR-41; AD-643781) CFSTI: HC $3.00/MF $0.65

In an earlier paper the Ginzburg-Landau free energy functional was used to calculate the effect of thermodynamic fluctuations on the off-diagonal correlation function and no off-diagonal long-range order was found in one- and two-dimensional systems. It has been pointed out that for a charged system the use of the Ginzburg-Landau free energy fluctional is in error for arbitrary non-equilibrium values of the order parameter since the electrostatic energy of the charge fluctuations associated with an arbitrary order parameter is not included in the free energy functional. A direct generalization of the free energy functional was not achieved. It was found that for uncharged systems the RPA gives a linearization of the results obtained earlier using the Ginzburg-Landau theory. For charged systems the RPA results were similar to those obtained for uncharged systems. It was concluded that it is very likely that, as in uncharged systems, there will be no ODLRO in charged infinite one- and two-dimensional systems. Author (TAB)

N67-20720# Army Electronics Labs., Fort Monmouth, N. J.

MICROWAVE PROPERTIES OF MANGANESE SUBSTITUTED Zn2Y SINGLE CRYSTALS AS A FUNCTION OF TEMPERATURE

Gilbert McCall and Lothar Maertin Sep. 1966 26 p refs

(ECOM-2762; AD-643753) CFSTI: HC $3.00/MF $0.65

The microwave resonance properties of Ba2Zn2-xMnx+yO22 have been studied over the temperature range of -196C to +120C. This particular series was selected for study because previous work showed that it possesses the narrowest linewidths of any known planar ferrites, thereby giving it the greatest probability of being used in device applications such as limiters, filters and harmonic generators. Data is given for anisotropy field and ferrimagnetic resonance linewidths as a function of temperature. Author (TAB)

N67-20746# California Inst. of Tech., Pasadena. W. M. Keck Lab. of Engineering Materials.

MOSSBAUER EFFECT OF Te^{125} IN SIMPLE CUBIC AND AMORPHOUS PHASES IN TELLURIUM-BASE ALLOYS

C. C. Tsuei Oct. 1966 13 p refs

(Contract AT(04-3)-221)

(Rept.-46; CALT-221-24) CFSTI: HC $3.00/MF $0.65

Recoilless resonant absorption of the 35.6-keV Gamma ray ($3/2^+$ to $1/2^+$ transition) in Te^{125} was observed in both simple cubic and amorphous tellurium-base alloys obtained by rapid cooling from the liquid state. As expected from its cubic symmetry, the simple cubic (one atom/unit cell) metastable $AuTe_2$ gives a single-peak Moessbauer spectrum with a half-width 0.88 cm/sec and an isomer shift of 0.08 cm/sec. The monoclinic $AuTe_2$, which is the equilibrium form of this compound, unexpectedly shows also a single-peak spectrum. However, the latter is about 24% broader than the former. On the basis of the atomic arrangement of the monoclinic $AuTe_2$, this line broadening is attributed to a weak quadrupole interaction. The Moessbauer spectrum of the metastable amorphous alloy $Te_{70}Cu_{25}Au_5$ exhibits a well-resolved quadrupole splitting of 0.74±0.02 cm/sec which is about the same as that of crystalline tellurium. The fact that the amorphous alloy has a quadrupole splitting of the same magnitude as that of crystalline tellurium confirms the hypothesis proposed previously that the metastable amorphous tellurium-base alloys consist of randomly oriented spiral chains of tellurium, with the atoms of the minor constituent(s) randomly distributed between the chains. Author (NSA)

N67-20748# Iowa State Univ. of Science and Technology, Ames. Inst. for Atomic Research.
ORDERING OF MAGNETIC IMPURITIES IN SUPERCONDUCTORS
D. K. Finnemore 19 Oct. 1966 4 p refs Presented at the Low Temp. Calorimetry Conf., Helsinki, 26 Aug. 1966
(Contract W-7405-ENG-42)
(IS-1453; CONF-660821-1) CFSTI: HC $3.00/MF $0.65

The changes in the superconducting characteristics as the magnetic ions order are investigated. The thermal conductivity of La 0.8 at. % Gd was measured from 5° to 0.3°K for magnetic fields up to 20,000 Oe. Experimental results show that the normal state conductivity is nearly linear in temperature and to an accuracy of 2% the thermal conductivity is independent of magnetic field. It is tentatively concluded that the electrons are the major carriers of heat and that the mean free path is limited by non-magnetic impurity scattering. K_s/K_n is plotted. Near T_c the data do not lie below the pure metal values as predicted by the theory, and at low temperatures the superconducting conductivity drops more abruptly than the theoretical curve. NSA

N67-20774# Iowa State Univ. of Science and Technology, Ames.
FERMI SURFACE OF TUNGSTEN
Robert Franz Girvan (Ph.D. Thesis) Jul. 1966 243 p refs
(Contract W-7405-ENG-82)
(IS-T-103) CFSTI: HC $3.00/MF $0.65

Impulsive-field de Haas–van Alphen effect measurements were carried out to study the Fermi surface of tungsten. An empirical model was constructed by fitting an equation for the shape of the Fermi surface to the results of this experiment combined with the Gantmakher size effect results of other investigators and with theoretical predictions for the Fermi surface shape. Good overall agreement is obtained between the predictions of the empirical model and experiment showing that a surface with the general features of the Lomer model can account for all of the experimental results. However, the empirical model is imprecise in certain respects, and small changes are indicated for a more precise description of the Fermi surface. Author (NSA)

N67-20785# Minnesota Univ., Minneapolis. School of Physics and Astronomy.
CURRENT-CARRYING STATES OF WEAKLY COUPLED SUPERCONDUCTORS
A. M. Goldman and P. J. Kreisman Sep. 1966 4 p refs Presented at the 10th Intern. Conf. on Low Temp. Phys., Moscow
(Contract AT(11-1)-1569)
(COO-1569-5; CONF-660816-6) CFSTI: HC $3.00/MF $0.65

Weakly coupled superconductors have been shown to be capable of sustaining quantized persistent currents, which under certain circumstances have long lifetimes. Earlier work was extended to the point where the observed current levels of weakly coupled superconductors may be quantitatively compared with theory. In particular, the dependence of the ring current level structure on temperature, through the temperature dependence of both the penetration depth and the maximum zero-voltage Josephson current, can be explicitly displayed. Preliminary results are described. NSA

N67-20814# Hamburg Univ. (West Germany). Inst. for Experimental Physics.
SILICON SURFACE BARRIER DETECTORS: FABRICATION, TEST METHODS, PROPERTIES, AND SOME APPLICATIONS [SILIZIUM-OBERFLAECHENSPERRSCHICHT-DETEKTOREN; HERSTELLUNG, TESTMETHODEN, EIGENSCHAFTEN UND EINIGE ANWENDUNGEN]
G. Andersson-Lindstroem and B. Zausig Bad Godesberg, West Germany, Bundesmin. fuer Wiss. Forschung, Jul. 1966 50 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Wiss. Forschung
(BMWF-FBK-66-24)

Investigations were performed on fabrication methods for silicon surface barrier detectors and their correlated properties. The resulting technique currently being applied is presented. The method is based on the use of high resistivity silicon material (10.000–30.000Ωcm). Some special tests and results for several properties are given in detail and examples of applications in nuclear experiments are described. Author (NSA)

N67-20833# Brookhaven National Lab., Upton, N. Y.
PRODUCTION OF LITHIUM DRIFTED GERMANIUM DETECTORS BY AC DRIFT
M. A. Jamini [1966] 17 p refs Presented at 13th Ann. Nucl. Sci. Symp., Boston
(Contract AT(30-2)-GEN-16)
(BNL-10683; CONF-661020-2) CFSTI: HC $3.00/MF $0.65

Thick planar detectors were produced by ac drifting. Lithium is diffused on two opposite surfaces of a p-germanium block, thus producing an n^+pn^+ structure with two diodes back to back. Drift then proceeds from the two surfaces on alternate half cycles of the ac field. When the two compensated regions meet, one n-contact is removed and replaced by a p-contact. Any remaining uncompensated regions are then compensated by a dc drift. The p-contact is produced by diffusing gallium–indium eutectic at 400°C. By this technique it is possible to drift as deep at 2 cm and thus to produce a large volume detector with low capacitance. Author (NSA)

N67-20852# Oak Ridge National Lab., Tenn. Solid State Div.
ULTRASONIC MEASUREMENT OF THE NON-LINEARITY PARAMETERS OF COPPER SINGLE CRYSTALS
Wilhelm Belrupt Gauster Sep. 1966 105 p refs
(Contract W-7405-ENG-26)
(ORNL-TM-1573) CFSTI: HC $3.00/MF $0.65

The nonlinearity parameters of neutron-irradiated copper single crystals were determined by measuring quantitatively the harmonic distortion of pulsed MHz. ultrasonic waves propagating in three crystallographic directions. For this purpose a capacitive detector was developed with which it is possible to detect and measure absolutely ultrasonic displacement amplitudes of the order of 10^{-10} cm. As verification of the technique, measurements on a single crystal of germanium were made. The results are in good agreement with those obtained for the same sample by another technique. The results of the copper experiments are combined with three published sets of values of the pressure derivatives of the second-order elastic constants to calculate three sets of the six third-order elastic constants. The problem of error propagation in this calculation is discussed. NSA

N67-20894# Picatinny Arsenal, Dover, N. J.
MEASUREMENT OF CHARGE TRAPPING CENTERS IN GEOLOGICAL SPECIMENS
P. D. Townsend 11 Aug. 1966 17 p refs Presented at Conf. on Appl. of Thermoluminescence to Geol. Probl., Spoleto, Italy, 5–16 Sep. 1966 Sponsored by NATO and AF Work done in part at Brookhaven Natl. Lab.
(Contract AT(30-2)-GEN-16)
(BNL-10545; CONF-660919-1) CFSTI: HC $3.00/MF $0.65

The use of crystal defects, in particular the determination of occupancy of charge trapping centers, to study thermal history or to make age determinations is discussed in terms of the physical

problems involved in making the measurements. The problems of defect production, annealing, and detection are outlined with emphasis on the role of charge transfer and distribution of charge between competitive defects. Examples of calculations of defect production are made to illustrate cases when there is simultaneous annealing and retrapping effects by the thermally unstable defects. The discussion leads to criteria which determine what defects are suitable for use as tools for dating. These criteria are used to examine examples of thermoluminescence data. Author (NSA)

N67-20914# United Kingdom Atomic Energy Authority, Harwell (England).

THE USE OF ELECTRONIC COMPUTERS IN SOLID-STATE PHYSICS FOR A GENERAL TRANSFORMATION OF COMPLICATED MATHEMATICAL EXPRESSION (ANALOGUE OF ALGEBRAIC CALCULATION WITH LITERAL SYMBOLS)

A. Scholz Jul. 1966 32 p
(NP-TR-1434) CFSTI: HC$3.00/MF$0.65

The advantages of using electronic computers in the theoretical treatment of complex physical processes and phenomena are discussed. Information is presented on programming computers in solid-state physics, and some typical examples of programming are included. NSA

N67-20984# General Electric Co., Philadelphia, Pa. Missile and Space Div.

STUDY OF SURFACE CONTOURING AS APPLIED TO SEMICONDUCTOR RADIATION DETECTORS Semiannual Report, Jul.–Dec. 1965

Gerald C. Huth, Robert J. Locker, and Russell A. Mc Kinney Jan. 1966 77 p refs
(Contract AT(30-1)-3246)
(NYO-3246-6) CFSTI: HC$3.00/MF$0.65

A report is presented on a study of carrier multiplication phenomena in a particular silicon diffused junction radiation detector and the applications of the detector. A systemized characterization of the contoured structure is discussed. Detection and potentially interesting spectroscopy of soft X-rays is also reported. NSA

N67-20985# General Electric Co., Philadelphia, Pa. Missile and Space Div.

STUDY OF SURFACE CONTOURING AS APPLIED TO SEMICONDUCTOR AND RADIATION DETECTORS Three Year Summary Report, 1963–1966

Gerald C. Huth, James B. Trice, Russell A. McKinney, and Robert J. Locker Jun. 1966 28 p refs
(Contract AT(30-1)-3246)
(NYO-3246-7) CFSTI: HC$3.00/MF$0.65

A summary is presented on work accomplished on determining the usefulness of surface contouring as applied to semiconductor radiation detectors. Topics discussed are contouring and junction perfection, contoured internally amplifying detectors, and specific measurements which utilize the contoured detector. NSA

N67-20988# General Electric Co., Philadelphia, Pa. Missile and Space Div.

STUDY OF SURFACE CONTOURING AS APPLIED TO SEMICONDUCTOR RADIATION DETECTORS Semiannual Report, Jan.–Jun. 1966

Gerald C. Huth, Robert J. Locker, Russell A. McKinney, and Donald A. Yerry Jul. 1966 51 p refs
(Contract AT(30-1)-3246)
(NYO-3246-8) CFSTI: HC$3.00/MF$0.65

A study of semiconductor physics and application of avalanching or internal amplification in silicon junction detectors is presented with emphasis on surface contoured detectors. The characteristics and detection capabilities of the countoured detector-tunnel diode circuit are investigated. NSA

N67-21023# Brookhaven National Lab., Upton, N. Y. Physics Dept.

COMPARISON OF ELECTROMAGNETIC AND NEUTRON STUDIES OF SOLIDS

M. Blume *In its* Inelastic Scattering of Neutrons by Condensed Systems Mar. 1966 p 1–7 (See N67-21022 10-26) CFSTI: HC$3.00/MF$0.65

Experiments involving electromagnetic radiation are considered and compared with neutron scattering experiments with emphasis on the scattering experiments. These experiments can be expressed in terms of time-dependent correlation functions. The usefulness of neutrons in studies of thermal and magnetic properties of solids compared with the usefulness of photons is emphasized. NSA

N67-21024# Atomic Energy of Canada, Ltd., Chalk River (Ontario). Nuclear Labs.

REVIEW OF EXPERIMENTAL MEASUREMENTS OF LATTICE MODES IN TRANSITION METALS

A. D. B. Woods *In* Brookhaven Natl. Lab. Inelastic Scattering of Neutrons by Condensed Systems Mar. 1966 p 8–15 refs (See N67-21022 10-26) CFSTI: HC$3.00/MF$0.65

The measured frequency (ν) versus wave vector (q) dispersion relations for niobium and tantalum (column V of the periodic table) are similar to one another, as are those for chromium, molybdenum, and tungsten (column VI). However, $\nu(q)$ for the column V metals are qualitatively different from those for the metals of column VI, suggesting that the dispersion relations are determined largely by the electronic structure through the electron–phonon interactions. The Λ_1 branch ($\Gamma \rightarrow P \rightarrow H$) was studied in considerable detail and displays one very striking and other smaller anomalies in both Nb and Mo. It is believed that these anomalies are manifestations of the Kohn effect; their positions correlate well with Fermi surface dimensions deduced from band structure calculations and from direct measurements on tungsten. Measurements on disordered alloys of the two materials indicate that the neutron groups for the phonons are not significantly broader than those for the pure metals, suggesting that the alloys may be treated in the same way as the pure metals but with their own characteristic electronic structure. The altered positions of suspected Kohn anomalies, and the average change in normal mode frequencies, can be correlated, on the assumption of the validity of the rigid band model, with calculations of the band structure and of the density of states for tungsten. Author (NSA)

N67-21026# Oxford Univ. (England). Dept. of Theoretical Physics.

IMPURITY AND ANHARMONIC EFFECTS IN NEUTRON SCATTERING PHONONS

R. J. Elliott *In* Brookhaven Natl. Lab. Inelastic Scattering of Neutrons by Condensed Systems Mar. 1966 p 23–28 refs (See N67-21022 10-26) CFSTI: HC$3.00/MF$0.65

A theoretical discussion of impurity and anharmonic effects on neutron scattering by phonons is given. It is concluded that although these effects are different in detail their qualitative form is similar. They change the one-phonon scattering cross sections from δ functions to lines of finite width somewhat shifted in position. The tails of these lines have specific shapes and are cut off at the high frequency end. NSA

N67-21027# Goteborg Univ. (Sweden). Inst. of Theoretical Physics.

ELECTRONIC EFFECTS ON LATTICE VIBRATIONS

Alf Sjolander *In* Brookhaven Natl. Lab. Inelastic Scattering of Neutrons by Condensed Systems Mar. 1966 p 29–43 refs (See N67-21022 10-26) CFSTI: HC $3.00/MF $0.65

A review of recent work on lattice vibrations in metals and semiconductors is given with particular emphasis on the role played by the valence and conduction electrons. For metals the effective ion-electron interaction and the screening from conduction electrons is discussed with reference to recent work of Toya, Sham, Harrison, Vosko, and others. Atomic vibrations is discussed on the basis of the shell model, and the work particularly of Cochran, Cowley, and Lax is referred to. The various effects are illustrated with figures showing experimental and theoretical results.
Author (NSA)

N67-21028# Commissariat a l'Energie Atomique, Saclay (France).
LATTICE DYNAMICS AND PHASE TRANSITIONS
N. Boccara *In* Brookhaven Natl. Lab. Inelastic Scattering of Neutrons by Condensed Systems Mar. 1966 p 44–48 refs (See N67-21022 10-26) CFSTI: HC $3.00/MF $0.65

The case in which lattice dynamics dominates in the occurrence of a transition in crystalline solids is considered. The main experimental facts are reviewed, and some of the most recent theoretical suggestions for explaining the facts and predicting new features of the transitions are presented. Also the main physical ideas and the predictions of a previous self-consistent theory are given.
NSA

N67-21029# Kyoto Univ. (Japan). Research Inst. for Fundamental Physics.
CRITICAL PHENOMENA
Hazime Mori *In* Brookhaven Natl. Lab. Inelastic Scattering of Neutrons by Condensed Systems Mar. 1966 p 49–56 refs (See N67-21022 10-26) CFSTI: HC $3.00/MF $0.65

The long-range correlation of spins and anomalous relaxation phenomena in ferromagnets and antiferromagnets near the critical points as typical examples of critical phenomena are discussed. Near the critical point, the correlation of spins becomes long range. This long-range correlation is the origin of all anomalies observed near the critical point. From this point of view and using a fluctuation–dissipation formula, the interpretation of the anomalous relaxation phenomena is explained by taking the spin diffusion process and the line width of the electron spin resonance. It is emphasized that neutron scattering experiments on the spin-pair correlation and longitudinal damping constant below the Curie point are useful, since their behavior is predicted to be different from that above the Curie point.
Author (NSA)

N67-21032# Cambridge Univ. (England). Cavendish Lab.
MEASUREMENTS OF THE FREQUENCIES OF THE NORMAL MODES OF MAGNESIUM
G. L. Squires *In* Brookhaven Natl. Lab. Inelastic Scattering of Neutrons by Condensed Systems Mar. 1966 p 78–82 refs (See N67-21022 10-26) CFSTI: HC $3.00/MF $0.65

The normal modes of magnesium were investigated by means of the inelastic scattering of slow neutrons. The frequencies of about 1000 phonons were measured with a time-of-flight apparatus, and the values along symmetry directions obtained by an interpolation method. It was found that previous results could be fitted by force models extending to fourth-nearest neighbors or less. The present measurements cannot be fitted by any tensor force model extending only to fourth-nearest neighbors.
Author (NSA)

N67-21033# Laboratoires du Centre d'Etude de l'Energie Nucleaire, Mol (Belgium).
LATTICE DYNAMICS OF NICKEL AND THE KREBS MODEL
S. Hautecler and W. van Dingenen *In* Brookhaven Natl. Lab. Inelastic Scattering of Neutrons by Condensed Systems Mar. 1966 p 83–87 refs (See N67-21022 10-26) CFSTI: HC $3.00/MF $0.65

The lattice dynamics of nickel was investigated by slow neutron spectroscopy. Phonon spectra were measured, in the (110) plane, by a time-of-flight technique. The incident monochromatic neutron beam is obtained by Gragg reflection, from a Pb single crystal, of a Befiltered reactor beam. Two hundred phonons were measured under 3 scattering angles (70°, 90°, and 100°). The scattering surfaces and the dispersion curves in the symmetry directions [100], [110], and [111] were deduced from these data. These last experimental results are compared with calculations based on a model proposed by Krebs for face-centered and body-centered cubic metals. A general agreement is found by choosing an appropriate value for the effective number of free electrons.
Author (NSA)

N67-21034# Los Alamos Scientific Lab., N. Mex.
CHARGED BOND CORRECTION TO THE DISPERSION CURVES OF DIAMOND
John L. Warren *In* Brookhaven Natl. Lab. Inelastic Scattering of Neutrons by Condensed Systems Mar. 1966 p 88–93 refs (See N67-21022 10-26) CFSTI: HC $3.00/MF $0.65

Phonon dispersion curves in the [100] and [111] directions for diamond have been measured previously by Warren and Yarnell and reported at the Symposium on Inelastic Scattering of Neutrons held in Bombay, India, during December 1964. These curves are fitted fairly well by a second neighbor Born–von Karman model. A really good fit to the data, however, requires at least fifth neighbors. It is known from X-ray diffraction studies that the electron charge distribution in diamond is nonspherically symmetric about the carbon nuclei. A small amount of charge is concentrated along the bonding directions. In an attempt to explain the long-range contribution to the dispersion curves we have calculated the electrostatic contribution to the dynamical matrix from a negative point charge constrained to remain midway between nearest neighbors. A compensating positive point charge was placed on the carbon atoms. The square of the amount of charge in the bond, Z^2, was left as a parameter. It was found that no positive value of Z^2 would improve the fit to the data over the fit obtained by a straight second neoghbor Born–von Karman model. Although the charge bond correction does not by itself explain the long-range contribution to the dispersion curves, it will have to be considered in any full treatment of the lattice dynamics of diamond.
Author (NSA)

N67-21037# European Atomic Energy Community, Ispra (Italy).
HYDROGEN MOTION IN PRIMARY SOLUTIONS OF HYDROGEN IN SOME TRANSITION ELEMENTS
W. Kley, J. Peretti, R. Rubin, and G. Verdan *In* Brookhaven Natl. Lab. Inelastic Scattering of Neutrons by Condensed Systems Mar. 1966 p 105–125 refs (See N67-21022 10-26) CFSTI: HC $3.00/MF $0.65

The scattering of cold neutrons from VH_x, NbH_x, and PdH_x systems was measured at low hydrogen concentrations. The difference between the normalized intensity of the "hydrogen system" and that of the pure host lattice reveals the neutron scattering distribution of the "hydrogen probe" in the host lattice. These intensity distributions show the expected high energy "local" modes of the hydrogen impurity well above the maximum frequency of the host lattice. For VH_x and NbH_x in the α phase, a low energy neutron distribution of a few meV is also observed, close to the energy of the impinging neutrons. Apart from a certain distortion near the maximum host lattice frequency, in addition, the host lattice frequency distribution can be "seen" through the hydrogen "band" modes. For Nb, two pronounced peaks are found at energy transfers of 25.9 and 18.3 meV. They agree reasonably well with recent calculations of the frequency distribution of Nb.
Author (NSA)

N67-21044# Atomic Energy Commission Research Establishment, Riso (Denmark).

INELASTIC SCATTERING OF NEUTRONS BY SPIN WAVES IN TERBIUM

H. Bjerrum Moller, P. A. Mogensen (Tech. Univ.), and A. Kowalska (Copenhagen Univ.) *In* Brookhaven Natl. Lab. Inelastic Scattering of Neutrons by Condensed Systems Mar. 1966 p 159–162 refs (See N67-21022 10-26) CFSTI: HC $3.00/MF $0.65

The spin wave spectrum of terbium was studied by the inelastic scattering of neutrons. A triple-axis spectrometer situated at the DR3 reactor was used for these experiments, and the spin wave dispersion curves were studied in symmetry directions in the hexagonal plane, using the "constant-Q" method with fixed energy of the scattered neutrons. The specimen was a single crystal of pure terbium metal in the approximate form of a cylinder 5 cm long and a 6 mm in diameter. It was placed in a cryostat at liquid nitrogen temperature. Well-defined neutron groups were observed for all the Q-values studied. Their amplitude was generally comparable with the background counting rate. From the observed dispersion curves in the [1,1,0,0] direction, preliminary values of exchange parameters are estimated. Author (NSA)

N67-21329# Maryland Univ., College Park. Materials Science Center.

MATERIALS SCIENCE PROGRAM Technical Report, 1 Jul. 1965–30 Jun. 1966

30 Jun. 1966 216 p
(Contract ARPA SD-101)
(AD-645165) CFSTI: HC $3.00/MF $0.65

This technical report describes research in the Materials Sciences carried on by the faculty and students at the College Park campus of the University of Maryland during the period from July 1, 1965 through June 30, 1966. Descriptions of the research accomplished during the year is compiled under eight subheadings: High pressure phenomena; intermolecular interactions, spectra and structure; electronic and magnetic properties of materials; electronic structure and fundamental interactions in solids; interaction of matter with electromagnetic radiation; thermodynamics and kinetics of reactions in materials; mechanical properties; and characterization of materials. TAB

N67-21331# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

CERTAIN FOUR COMPONENTS OF A SEMICONDUCTIVE PHASE

O. V. Voytsekhivs'kyy 27 Sep. 1966 9 p refs Transl. into ENGLISH from Ukr. Fiz. Zh. (Kiev), v. 9, no. 7, 1964 p 796–797
(FTD-HT-66-173; TT-67-60291; AD-644011) CFSTI: HC $3.00/MF $0.65

The report is a part of systematic investigations of four component semiconductive phases of changed composition of the type of solid displacement solutions within the limits of the crystallochemical group of diamonds and the object is to examine the nature of the reaction of certain semiconductor compounds, which have the structure of zinc blende and chalkopyrite. TAB

N67-21333# Rochester Univ., N. Y. Dept. of Physics and Astronomy.

GENERATION AND DETECTION OF COHERENT ELASTIC WAVES IN QUARTZ AT 114,000 MC/SEC Final Report, 1963–1966

E. H. Jacobsen and John Ilukor Oct. 1966 14 p refs
(Contract Nonr-668(22))
(AD-642807) CFSTI: HC $3.00/MF $0.65

Coherent elastic waves have been generated and detected at 114,000 megacycles per second in crystalline quartz at liquid-helium temperatures. A low-power klystron and superhetrodyne receiver with synchronous detector were used as transmitter and receiver, respectively. Measurements of attenuation vs. temperature suggest that acoustic losses proceed via the three phono processes. Effective power input to the cavity was approximately 3 milliwatts because of large wave guide losses at these frequencies. The general results suggest the feasibility of similar experiments, employing the piezoelectric effect, at considerably higher frequencies. Author (TAB)

N67-21353# Northrop Corp., Newbury Park, Calif. Applied Research Dept.

DEVICE PERFORMANCE CHARACTERISTIC AS RELATED TO RADIATION DAMAGE IN SEMICONDUCTOR MATERIALS Final Report, Jun. 1965–Jun. 1966

George C. Messenger, Donavon D. Pretzer, William W. Chang, Stewart G. Kimble, and Edward J. Steele Jun. 1966 236 p refs
(Contract AF 19(628)-5113)
(ARD-66-42-R; AFCRL-66-462; AD-643783) CFSTI: HC $3.00/MF $0.65

Radiation damage to bulk semiconductor materials and semiconductor devices has been investigated. Though the space radiation environment has been discussed, primary emphasis has been placed on the nuclear radiation environment since more experimental work has been done in the latter field. The Hall-Shockley-Read equations for describing minority carrier lifetime as a function of a single recombination level has been modified to account for the presence of two recombination levels. The resulting equations are in reasonably good agreement with the experimental work of O.L. Curtis on neutron damage to bulk silicon. The latest experimental work on radiation damage to bipolar transistors, semiconductor diodes, field effect transistors, and integrated circuits has been reviewed. Suggestions are included for establishing the minimum number of experimental and theoretical programs necessary to obtain the information required to eventually produce semiconductor devices which are relatively insensitive to the known radiation environments. TAB

N67-21356# Westinghouse Electric Corp., Elmira, N. Y. Electronic Tube Div.

SOLID STATE IMAGE INTENSIFIERS Monthly Technical Engineering Report, Aug. 1–31, 1966

D. C. Fowlie, M. A. Novice, and Z. Szepesi 1 Sep. 1966 6 p
(Contract N61339-66-C-0064)
(MTER-5; AD-642848) CFSTI: HC $3.00/MF $0.65

The purity of the actual materials used in the preparation of PC layers has been re-checked. CdSe mixtures containing 0.015% CuC12 gave PC layerswith acceptable characteristics for present experiments. Work on insulating opeque films was continued and some problems connected to the modular construction of image intensifiers were examined. Author (TAB)

N67-21371# Library of Congress, Washington, D. C. Aerospace Technology Div.

ORGANIC SEMICONDUCTORS: COMPREHENSIVE REPORT Surveys of Foreign Scientific and Technical Literature

Serge Markov 30 Jun. 1966 57 p refs
(ATD-66-84; TT-67-60340; AD-644463) CFSTI: HC $3.00/MF $0.65

The comprehensive report is based on Soviet open sources published 1960-1965 with a few sources published earlier. It is the third report of a series covering Soviet literature on organic semiconductors. The subject of this series is basically Soviet research on the electrical properties of organic semiconductors and photoconductors. Material has also been included dealing with the

preparation of such products, known or potential, and with their structure, morphology, and magnetic properties insofar as these are associated with electrical properties. The report concludes the topic of polymers with a continuous system of double bonds in the backbone. It covers polyarylenes, polyazoarylenes, polyazines, polymeric Schiff bases, polymers with pyridinyl, vinyl, and phenyl groups in the backbone, onium polymers, and aniline black and similar substances. TAB

N67-21375# Pennsylvania Univ., Philadelphia. Dept. of Physics.
ANTIFERROMAGNETICALLY COUPLED SPIN IMPURITIES IN FERROMAGNETS
Herbert Callen and Yung-Li Wang Nov. 1966 8 p ref
(Contract Nonr-551(36))
(TR-32; AD-644077) CFSTI: HC$3.00/MF$0.65

A rigorous theory is given of the ground state of an antiferromagnetically-coupled spin impurity (s = 1/2) in a ferromagnetic host (of arbitrary S). This is compared with the results of spin wave theory, providing some insight into the corresponding calculation for a pure antiferromagnet. Author (TAB)

N67-21394*# National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio.
THE INFLUENCE OF THE ATOMIC NATURE OF CRYSTALLINE MATERIALS ON FRICTION
Donald H. Buckley Washington, NASA, 1967 34 p refs To be presented at the Am. Soc. of Lubrication Engr. and Am. Soc. of Mech. Engr. Lubrication Conf., Chicago, 17–19 Oct. 1967
(NASA-TM-X-52279) CFSTI: HC$3.00/MF$0.65 CSCL 20B

The arrangement of atoms in crystalline materials is discussed with reference to lattice, planes, and crystal structure. The effect of atomic structure is considered in terms of its influence on mechanical properties with particular emphasis on those related to friction, namely deformation and shear. Friction data are presented for body centered cubic, face centered cubic and hexagonal metals, as well as for crystals of inorganic compounds. The data were primarily obtained in a vacuum environment where the effects of material structure on friction could be measured without the presence of contaminating surface films. The friction results presented are for various planes and for various directions on the planes of single crystals. Data are also presented to show the relation of observation with single crystals to those with polycrystalline materials. The data indicate that friction is anisotropic and is generally lowest on the greatest atomic density planes of crystalline materials when sliding in the direction of most closely packed planes. This relation appears to hold for many crystals of inorganic compounds as well as for various crystal forms of metals. Author

N67-21428# Georgia Inst. of Tech., Atlanta. Engineering Experiment Station.
MILLIMETER AND SUBMILLIMETER WAVE DIELECTRIC MEASUREMENTS WITH AN INTERFERENCE SPECTROMETER
K. H. Breeden and A. P. Sheppard 17 Nov. 1966 26 p refs
(Contract Nonr-991(13))
(TR-1; AD-644523) CFSTI: HC$3.00/MF$0.65

Applications of an interference spectrometer in measuring complex permittivity of dielectric materials are described. An interferometer technique is employed for the dielectric constant measurements and an error analysis is included in this discussion. The loss tangent measurements use a power spectrum technique in which wide resolution bandwidth is used to average out the effects of multiple reflections introduced by a sample of finite thickness. Results of dielectric constant measurements at 71 GHz and 250-450 GHz are tabulated along with results of loss tangent measurements at 400, 600, and 1000 GHz for several commonly employed materials of interest to microwave systems engineers. Author (TAB)

N67-21467# Oak Ridge National Lab., Tenn.
THE EFFECT OF NEUTRON IRRADIATION ON PLASTIC DEFORMATION IN NIOBIUM SINGLE CRYSTALS
R. P. Tucker (M.S. Thesis—Tenn. Univ., Knoxville) Nov. 1966 162 p refs
(Contract W-7405-ENG-26)
(ORNL-TM-1583) CFSTI: HC$3.00/MF$0.65

Unirradiated and irradiated single-pass, electron-beam-zoned Nb single crystals oriented for maximum resolved shear stress on the (T01) [111] slip system were plastically deformed in tension at 25°C. The changes upon irradiation in slip line appearance, yielding characteristics with neutron dose, and dislocation dynamics as determined by stress relaxation were investigated. The results do not clearly establish the form of the stress dependence of the dislocation velocity. NSA

N67-21496# California Univ., Livermore. Lawrence Radiation Lab.
U-JUNCTION Ge(Li) DRIFT DETECTORS
Guy A. Armantrout 15 Oct. 1966 12 p refs Presented at the 13th Nucl. Sci. Symp., Boston, 19–21 Oct. 1966 Submitted for publication
(Contract W-7405-ENG-48)
(UCRL-14926; CONF-661020-6) CFSTI: HC$3.00/MF$0.65

A U-junction drifting configuration was used which permits the fabrication of large volume, low-capacitance detectors in much less time than previously required. For example, it is now possible, with good material, to fabricate in approximately one week an 18-cm^3 diode with 3-pF capacitance. The U-junction structure is partially wrapped around three sides of a parallelepiped of the desired dimensions. The drifting then proceeds toward the remaining side of the detector. At the completion of the drift, only a narrow strip of P-type material remains along one edge. The portion of the lithium junction used for the rapid drift is now lapped off, leaving the low-capacitance junction structure for the collection of the charge. No further processing is required, and the diode is ready for mounting. Initial tests on two 6-cm^3 U-junction detectors indicate that the diodes have the expected capacitance of about 2 pF and a relatively thin window. A resolution of 705 eV for the 60-keV gamma ray of ^{241}Am was thus far obtained, and the measured Fano factor of 0.157 is consistent with the currently accepted value. Author (NSA)

N67-21539# Brookhaven National Lab., Upton, N. Y.
EQUIVALENCE OF HYSTERESIS AND PHASE EQUILIBRIA: THE THERMODYNAMIC ORIGIN OF HYSTERESIS IN SUPERCONDUCTORS
Donald G. Schweitzer [1965] 8 p refs
(Contract AT(30-2)-GEN-16)
(BNL-9629) CFSTI: HC$3.00/MF$0.65

The thermodynamic properties of hysteresis loops are described and it is shown that they are also general properties of equilibrium phase systems. In the examples given the major hysteresis loops of "irreversible" superconductors are considered. It is shown that the thermodynamic argument for the stability of trapped flux given in other works (BNL-9628) also accounts for hysteresis. NSA

N67-21540# European Organization for Nuclear Research, Geneva (Switzerland).
SOME APPLICATIONS OF SUPERCONDUCTIVITY
W. Klose 19 Oct. 1966 32 p refs
(CERN-66-32)

The fundamental properties of superconductors are discussed in terms of persistent currents, critical magnetic field, magnetization, critical currents, and intermediate and mixed states. Other topics

considered include: thermodynamics of superconductors, electrodynamics of superconductors (London Theory), microwave absorption (Pippard Theory), high-field superconductors, thermodynamics of high-field superconductors (Ginzburg–Landau theory), and superconducting devices. NSA

N67-21598# Brookhaven National Lab., Upton, N. Y.
CRITICAL MAGNETIC SCATTERING FROM $KMnF_3$
M. J. Cooper and R. Nathans 1965 25 p refs
(Contract AT(30-2)-GEN-16)
(BNL-9615) CFSTI: HC $3.00/MF $0.65

Critical magnetic scattering experiments on the simple ionic antiferromagnet $KMnF_3$ are described. The observed intensity distributions are compared with those calculated from the Van Hove theory for quasi-elastic scattering using an experimentally determined resolution function. Excellent agreement is obtained with the Ornstein–Zernike form for the radial dependence of the correlation function in the temperature range $1.002 < T/T_c < 1.1$. The correlation range is found to increase from 12 Å at $T/T_c = 1.1$ to 200 Å at $T/T_c = 1.002$, and the inverse staggered susceptibility is found to follow very closely a 4/3 power law dependence on $T-T_c$. The results are also compared with recent results on ferromagnetic metals. Author (NSA)

N67-21621# Westinghouse Electric Corp., Pittsburgh, Pa. Research Labs.
THE ADSORPTION OF OXYGEN ON TUNGSTEN AT TEMPERATURES FROM 300°K TO 850°K
J. H. Singleton 24 Oct. 1966 39 p refs
(Contract AT(30-1)-2823)
(WERL-2823-23) CFSTI: HC $3.00/MF $0.65

The adsorption of oxygen was studied on a polycrystalline tungsten ribbon, at temperatures from 300 to 765°K. Two types of tungsten surface structure were distinguishable by their adsorption and desorption behavior. At 300°K, adsorption on either type of surface occurred into a single phase, but at higher temperatures, to a maximum of ≈765°K, additional adsorption occurred, with an energy of activation of ≈0.25 eV. This process probably involves a reconstruction of the tungsten surface rather than the adsorption into a pre-existing set of sites. Solution of oxygen is observed at temperatures between 800 and 1000°K, and the data are consistent with the model of a process restricted to the surface layers of the tungsten. The removal of adsorbed oxygen, in a high-temperature flash, occurs only by oxide evaporation below ≈1650°K and by evaporation of both an oxide and oxygen, above this temperature. Author (NSA)

N67-21629# Oak Ridge National Lab., Tenn.
RADIATION EFFECTS IN SEMICONDUCTORS
James H. Crawford, Jr. [1966] 44 p refs Presented at the Solid State Conf. on Interaction of Radiation with Solids, Cairo, 3–7 Sep. 1966 Submitted for publication
(Contract W-7405-ENG-26)
(ORNL-P-2515; CONF-660923-3) CFSTI: HC $3.00/MF $0.65

The correlation between high-energy radiation damage to crystal lattices in semiconductors and the presence of imperfections in their crystalline structure was investigated. The nature of radiation defects, particularly in the systems of Ge and Si, was studied, as was the influence of these defects on the behavior of semiconductors. A result of the investigation was a better understanding of the complexities involved in the identification of the imperfections responsible for the acceptor and donor states in Ge, Si, and other semiconductors. NSA

N67-21681# Case Inst. of Tech., Cleveland, Ohio.
SOLID STATE PHYSICS PROGRAM Annual Progress Report
Charles S. Smith 1 Nov. 1966 31 p
(Contract AT(11-1)-623)
(COO-623-115) CFSTI: HC $3.00/MF $0.65

This report, covering the period Nov. 1965, through Oct. 1966, includes abstracts of five technical reports issued, brief descriptions of work still in progress, and an outline of proposals for future research. Reports for which abstracts are given concerned electronic structure of liquid metals, internal stress and annealing of Fe films, pressure derivatives of the elastic constants of CaF_2, and energy gaps in disordered systems. Brief descriptions of work on the following are included: magnetic measurements on thin films, thermal expansion of NaF, elastic constants of RbI at low temperatures, pressure derivatives of the elastic constant of Cu, Bloch electrons in a magnetic field, and valence band structure of diamonds. NSA

N67-21790# Iowa State Univ. of Science and Technology, Ames.
ULTRASONIC PROPAGATION IN Mg_2Pb
P. L. Chung and G. C. Danielson Sep. 1966 29 p refs
(Contract W-7405-ENG-82)
(IS-1451) CFSTI: HC $3.00/MF $0.65

A resonance technique to determine the ultrasonic wave propagation constants in semiconductors was developed. The technique employs a standard Q meter. The longitudinal and transverse sound velocities of Mg_2Pb in the [100] and [110] directions were determined at room temperature. The elastic constants from these measurements were calculated to be $C_{11} = 7.16 \times 10^{11}$ d/cm^2, $C_{12} = 2.21 \pm 10^{11}$ d/cm^2, and $C_{44} = 3.09 \pm 10^{11}$ d/cm^2. The errors in these determinations of the elastic constants were estimated to be less than 1%. The interrelationship of the elastic constants suggests that Mg_2Pb probably has predominantly covalent bonds like the other three compounds in this family, Mg_2X (X = Si, Ge, Sn or Pb). Author (NSA)

N67-21797# Oak Ridge National Lab., Tenn.
DOPING OF SEMICONDUCTORS USING ION IMPLANTATION TECHNIQUES
G. D. Alton and L. O. Love Jun. 1966 8 p Presented at the Ion Beam Bombardment and Doping of Semicond. Conf., Pasadena, Calif.
(Contract W-7405-ENG-26)
(ORNL-TM-1495; CONF-651073-1) CFSTI: HC $3.00/MF $0.65

The calutron-type electromagnetic isotope separator was employed as a means of implanting Group III and V elements to produce n–p, p–n, and n–p–n junctions in silicon, silicon carbide, gallium arsenide, and germanium. The ability to control kinetic energies and doping levels and the discrete range of penetration achieved make use of this instrument desirable in permanent-type conversion of semiconductor surfaces. In order to obtain uniform deposition over sizable substrate areas, maximize the amount of data obtainable per bombardment period, and minimize the cost of bombardments, special techniques and equipment were developed to permit multiple substrate irradiations. The source and receiver components used and the doping techniques employed are described. Author (NSA)

N67-21803*# Oak Ridge National Lab., Tenn.
TEMPERATURE DEPENDENCE OF THE RESPONSE OF LITHIUM-DRIFTED GERMANIUM DETECTORS TO GAMMA RAYS
M. M. El-Shishini (M.S. Thesis) and W. Zobel Sep. 1966 78 p refs
(NASA Order R-104(1); Contract W-7405-ENG-26)
(NASA-CR-83250; ORNL-TM-1295) CFSTI: HC $3.00/MF $0.65
CSCL 20L

While it has generally been stated that lithium-drifted germanium detectors must be operated at liquid nitrogen temperature for optimum performance, no systematic investigation to prove or disprove this statement has been reported. The closest experiment is that of Tavendale who, however, only investigated the resolution as a function of temperature for one low energy gamma ray. The resolution and efficiency of two lithium-drifted germanium detectors, approximately 20-mm diameter and 3-mm thickness were studied in the temperature range from 85° to 160°K, using gamma ray sources whose energies varied from 279 to 1332 keV. It was found that, contrary to the results of Tavendale, the resolution of the detectors had a pronounced peak at about 105°K. The origin of this peak is not known, but is not due to changes in diode capacitance or leakage current. The efficiency of the diodes is approximately constant for each energy over the temperature range. Author (NSA)

N67-21818# California Univ., Livermore. Lawrence Radiation Lab.
SUPERCONDUCTING COILS FOR BASEBALL-TYPE MINIMUM-B FIELDS
Clyde Taylor 30 Sep. 1966 10 p ref Presented at the Symp. on Eng. Probl. of Controlled Thermonucl. Res., Gatlinburg, Tenn., 3–6 Oct. 1966 Submitted for publication
(Contract W-7405-ENG-48)
(UCRL-70023; CONF-661016-27) CFSTI: HC $3.00/MF $0.65

The "baseball" coil for producing "minimum B" magnetic fields is described. The magnetic force distribution on the coil is shown. Diagrams of the apparatus are given. NSA

N67-21833*# University of Southern Calif., Los Angeles. Electronic Sciences Lab.
[SOLID STATE, APPLIED ELECTROMAGNETICS AND PLASMS, AND INFORMATION SCIENCES RESEARCH] Consolidated Semiannual Progress Report No. 3, 1 Oct. 1965–31 Mar. 1966
31 Mar. 1966 134 p refs
(Grant NGR-05-018-022; Contracts AT(11-1)-113; Nonr-228(34); AF 04(695)-746; N123(60530)52008A et al)
(NASA-CR-83249; TID-22992) CFSTI: HC $3.00/MF $0.65 CSCL 20L

Summaries of solid state research in the areas of semiconductors, magnetism, crystals, and superconductivity are presented. Electromagnetic wave propagation in bounded, magnetized, hot plasmas, radiation and diffraction of electromagnetic waves and millimeter waves are research topics also reported. Information sciences are discussed with respect to the following: control systems, information processing and signal design theory, coding theory and automata studies, and hybrid and digital computation. NSA

27 PROPELLANTS

Includes fuels; igniters; and oxidizers. For basic research see: 06 Chemistry; and 33 Thermodynamics and Combustion. For related information see also: 28 Propulsion Systems.

N67-21321# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
FUELS FOR JET ENGINES
Ya. B. Chertkov, G. F. Bel'shako, and Ye. I. Gulin 13 May 1966 205 p refs Transl. into ENGLISH of the book "Topliva Dlya Reaktivnykh Dvigateley" Lenigrad, Leningrad: Izd. An SSSR, 1964 p 1–226
(FTD-MT-66-02; TT-67-60329; AD-644109) CFSTI: HC $3.00/MF $0.65

Contents: Sort grading of jet fuels and requirements for their quality; Physical properties of jet fuels; Chemical composition of jet fuels; Change in quality of jet fuels during storage; Pumpability of jet fuels; Thermooxidizing stability and antiwear properties of jet fuels; Evaporation and combustion of jet fuels. TAB

28 PROPULSION SYSTEMS

Includes air breathing, electric, liquid, solid, and magnetohydrodynamic propulsion. For nuclear propulsion see: 22 Nuclear Engineering. For basic research see: 23 Physics, General; and 33 Thermodynamics and Combustion. For applications see: 31 Space Vehicles. For related information see also: 27 Propellants.

N67-20509*# Colorado State Univ., Fort Collins. Coll. of Engineering.
ADVANCED ELECTRIC PROPULSION RESEARCH Annual Report, 1 Jan.–31 Dec. 1966
William R. Mickelsen Jan. 1967 146 p refs
(Grant NGR-06-002-032)
(NASA-CR-83034; MER-66-67WRM-6; Rept.-3) CFSTI: HC $3.00/MF $0.65 CSCL 21C

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9. FACILITIES AND EXPERIMENTAL EQUIPMENT V. A. Sandborn, J. P. Rybak, and R. L. Moore 8 p refs (See N67-20518 10-11)

N67-20510*# Colorado State Univ., Fort Collins. Coll. of Engineering.
ELECTRIC PROPULSION FOR PAYLOAD TRANSPORT FROM MOON TO EARTH

William R. Mickelsen and Timothy D. Fehr *In its* Advanced Elec. Propulsion Res. Jan. 1967 20 p refs (See N67-20509 10-28) CFSTI: HC $3.00/MF $0.65

The mission analysis for payload transport from the moon to the earth is discussed. Constant-thrust mission analysis and the approximation method of the Zola characteristic length for the earth–moon transfer are briefly reviewed. The mission profile is outlined for studying the potential performance of electric spacecraft for lunar surface–earth transport, the payload mass is determined for various conditions, and the typical results are graphed. The effect of propulsion system specific mass on payload transport, and the payload capacity of an all-chemical-rocket transport are also determined. It was concluded that the electric spacecraft would be superior to all-chemical-rocket spacecraft for 100-day missions if the electric propulsion system specific mass is less than 66 lb/kWj. N.E.N.

N67-20511*# Colorado State Univ., Fort Collins. Coll. of Engineering.

RADIOISOTOPE HEATING OF CONTACT IONIZERS

William R. Mickelsen *In its* Advanced Elec. Propulsion Res. Jan. 1967 18 p refs (See N67-20509 10-28) CFSTI: HC $3.00/MF $0.65

The possibility of using radioisotopes for heating ionizers in contact ionization thrustors is discussed. The propulsion system/mass ratio and the payload/mass ratio are considered, along with the heater power, power decay ratio, and the specific impulse with respect to the effective specific mass of the thrustor system. It is concluded that the radioisotope heated contact thrustor cannot be used with the large Saturn V class booster, but can be for smaller Saturn IB/Centaur boosters for short range applications. The analysis was confined to primary electric propulsion, but it is feasible for satellite attitude and position control also. N.E.N.

N67-20512*# Colorado State Univ., Fort Collins. Coll. of Engineering.

PROPELLANT FROM SPENT TANKAGE

William R. Mickelsen *In its* Advanced Elec. Propulsion Res. Jan. 1967 6 p refs (See N67-20509 10-28) CFSTI: HC $3.00/MF $0.65

The mission performance gains resulting from utilization of spent booster tankage as propellant source for electric propulsion spacecraft is discussed. The closed-form analysis for evaluating the performance gains is described, and results are graphed. It was determined that the payload gains will be greatest for the more difficult missions. N.E.N.

N67-20513*# Colorado State Univ., Fort Collins. Coll. of Engineering.

THERMAL POWER AUGMENTATION IN ELECTRIC PROPULSION SYSTEMS

William R. Mickelsen *In its* Advanced Elec. Propulsion Res. Jan. 1967 15 p refs (See N67-20509 10-28) CFSTI: HC $3.00/MF $0.65

The performance of the augmented-thermally electric propulsion (ATEP system is compared with conventional electric propulsion systems. It is determined that substantial reductions in propulsion system specific mass are theoretically possible with the ATEP system. The effect of propulsion system mass reduction on payload fraction is also considered. The analysis indicates that significant improvement in performance is possible when the nozzle exhaust velocity is about 0.3 or more of the final jet velocity. It was also shown that: (1) Systems having solid core nuclear reactors as prime power sources would require a propellant with a low molecular weight. (2) Electrothermal thrustors used in ATEP systems would require heat added to a supersonic stream. (3) An ATEP system using plasma thrustors would have to have plasma generation in a supersonic stream with appropriate density. (4) If electrostatic thrustors were used in an ATEP system, means for achieving a reasonably high current density in a space charge-limited accelerator would have to be found. N.E.N.

N67-20514*# Colorado State Univ., Fort Collins. Coll. of Engineering.

APPLICATIONS OF THE ATEP CONCEPT

Daniel C. Garvey and William R. Mickelsen *In its* Advanced Elec. Propulsion Res. Jan. 1967 31 p refs (See N67-20509 10-28) CFSTI: HC $3.00/MF $0.65

Preliminary results of the feasibility study of using electrostatic electrothermal thrustors in the augemented-thermally electric propulsion (ATEP) system are discussed. The operation of the ATEP system with liquid lithium is outlined. The performances of the ATEP system utilizing charged colloidial particles are compared for electrostatic and thermally-augmented electrostatic systems. The analysis indicates that an increased jet/power area is achieved in colloid particle electrostatic thrustors. The theoretical performance of electrothermal thrustors with supersonic inlet velocities, and having a reactor to provide power for the electrical heating of the propellant is also evaluated, and results are graphed. N.E.N.

N67-20515*# Colorado State Univ., Fort Collins. Coll. of Engineering.

ALUMINUM COLLOID FORMATION BY HOMOGENEOUS NUCLEATION

William R. Mickelsen *In its* Advanced Elec. Propulsion Res. Jan. 1966 8 p (See N67-20509 10-28) CFSTI: HC $3.00/MF $0.65

Initial calculations for the nucleation rate, and nozzle, charging chamber, and electrostatic accelerator designs are reported. The program calls for generating aluminum colloid particles, in the size range needed for electrostatic thrustors, from spent booster tanks. The nucleation rate is calculated as a function of axial distance in a conical supersonic nozzle. Stream temperatures where the theoretical nucleation rate is maximum were also determined. The results are graphed, and schematics of the conceptual are presented. N.E.N.

N67-20516*# Colorado State Univ., Fort Collins. Coll. of Engineering.

ALUMINUM-OXIDE COLLOID FORMATION BY VAPOR-PHASE CHEMICAL REACTION

Seong W. Shin, G. W. Tomkin, Jr., and William R. Mickelsen *In its* Advanced Elec. Propulsion Res. Jan. 1967 18 p refs (See N67-20509 10-28) CFSTI: HC $3.00/MF $0.65

Preliminary investigations for forming colloid particles in colloid thrustors are presented, and research pertinent to the study is reviewed. Aluminum would be available from spent tankage, and the oxidant would be available from open cycle life maintainance systems. Both experimental and analytical data are considered. Publications concerning the composition of the flame gases for an adiabatic flame temperature are discussed. Particle size distribution and methods of improving ideal thrustor efficiency are also considered. N.E.N.

N67-20592# General Electric Co., Cincinnati, Ohio. Flight Propulsion Div.

INVESTIGATION OF HIGH GAS TEMPERATURE UTILIZATION FOR ADVANCED TIP TURBINE FANS

Marvin R. Simonson Aug. 1966 64 p refs

(Contract DA-44-177-AMC-218(T))

(R66FPD198; USAAVLABS-TR-66-37; AD-643026) CFSTI: HC $3.00/MF $0.65

Studies made of cooling systems for tip-turbine cruise fans are discussed. These studies include a review of planned and predicted core engine exhaust gas conditions; the conceptual design and evaluation of several turbine bucket-carrier cooling systems; sandwich-type double-wall duct constructions; and the definition of advanced material and future test program requirements. Author (TAB)

N67-20683# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
LIQUID-FUEL ROCKET ENGINES
V. A. Tyutyunov and S. I. Lovinskiy 13 Sep. 1966 21 p Transl. into ENGLISH from Aviats. Dvigateli (Moscow), 1964 p 310–327 (FTD-MT-66-41; AD-644000) CFSTI: HC $3.00/MF $0.65

Basic structural elements of liquid-fuel rocket engines are: (1) combustion chamber, consisting of head, combustion chamber itself, and nozzle. In combustion chamber occurs burning of fuel and conversion of heat to kinetic energy of stream of gases, as a result of which jet thrust is created. In chamber complicated thermodynamic processes take place, and there are colossal heat flows; (2) fuelfeed system, consisting of fuel tanks, device for forced supply of components of fuel to chamber, lines, and fittings; (3) ignition system, intended to ignite fuel for starting. Engines using spontaneously inflammable fuel have no ignition system. TAB

N67-21166*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
POSSIBLE METEOROID HAZARD TO SOLID-PROPELLANT ROCKET MOTORS
Carol L. Robillard 1 Nov. 1964 28 p refs
(Contract NAS7-100)
(NASA-CR-83118; JPL-TM-33-186) CFSTI: HC $3.00/MF $0.65 CSCL 21H

Available data on hypervelocity penetration and on near-Earth and deep-space meteoroid environment were examined, and an attempt to determine the probable extent of meteoroid hazard to solid-propellant rocket motors was made. The probabilities of critical penetration for a small and a large solid-propellant spacecraft motor were estimated for a typical unmanned Mars mission. The values suggest that higher chamber pressures at a small loss in performance may be a good investment. It was found that the most interesting observations about probability of puncture of solid-propellant rocket motor cases depend only on the slope of the penetrating-flux curve and not on the magnitude of the meteoroid flux. The probability of puncture is proportional to the slope $(-\eta)$ of the penetrating meteoroid flux vs penetration-depth curve. Provided η is greater than two, the probability of puncture decreases with increasing motor-case radius, and with increasing chamber pressure. Author

N67-21393*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
STATUS OF THE 260-INCH DIAMETER SOLID ROCKET MOTOR PROGRAM
Carl C. Ciepluch Washington, NASA, 1967 18 p Presented at the 2d Solid Propulsion Conf., Anaheim, Calif., 6–8 Jun. 1967 Sponsored by the Interagency Chem. Rocket Propulsion Group and AIAA
(NASA-TM-X-52275) CFSTI: HC $3.00/MF $0.65 CSCL 21H

The progress made toward the third 260-inch diameter solid propellant rocket motor (260 SL-3) test firing is reported. The 260 SL-1 case has been refurbished, rehydrotested, and reinsulated. Development of a 50% higher burn rate propellant than that used in 260 SL-1 and SL-2 has been completed. The propellant incorporates a new and more effective burn rate catalyst. Processability of the propellant remains very similar to the previous propellant. Some degradation in propellant mechanical properties has been encountered. Fabrication of nozzle ablatives is nearing completion and fabrication of the nozzle shell and entrance ring has been completed. A cold flow aerodynamic investigation of the 260 SL-3 nozzle geometry has revealed the presence of high velocity circumferential flows behind the submerged nozzle entrance section. This is attributed to the asymmetric nozzle entrance flow emanating from the star port geometry. Motor tail-off is to be controlled by the use of inert slivers. A study of the optimum inert sliver size has indicated that the sliver should replace about 1% of the motor propellant. Author

N67-21842# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THERMODYNAMIC AND BALLISTIC DESIGN FUNDAMENTALS OF SOLID-PROPELLANT ROCKET ENGINES
B. V. Orlov and G. Yu. Mazing 16 Jun. 1966 397 p refs Transl. into ENGLISH of the book "Thermodinamicheskiye i Ballisticheskiye Osnovy Proyektirovani ya Raketnykh Dvigateley na Tverdom Toplive" Moscow, Izd. Mashinostr., 1964 p 1–406
(FTD-MT-65-191; TT-67-60490; AD-645793) CFSTI: HC $3.00/MF $0.65

In this book, on the basis of materials published in the Soviet and foreign press, there are expounded thermo-gas-dynamic principles of designing of rocket engines, engineering methods of calculation of processes of heat exchange, principles of the theory of burning of solid fuels and calculation of the indicated pressure curve in the combustion chamber of the engine. In it there is given basic information about solid rocket propellants applied in solid-propellant rocket engines (SPRE). There is considered regulation of thrust in SPRE in magnitude and direction, and also a general method of ballistic designing of solid-fuel rockets. Author (TAB)

29 SPACE RADIATION

Includes cosmic radiation; solar flares; solar radiation; and Van Allen radiation belts. For related information see also: 13 Geophysics; and 24 Physics, Atomic, Molecular, and Nuclear.

N67-20390 Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
INVESTIGATION OF THE SOFTEST CORPUSCLES WITH THE KOSMOS 3 AND KOSMOS 5 SATELLITES
T. M. Mulyarchik *In its* Cosmic Res. 23 Jun. 1966 p 152–167 refs (See N67-20381 10-30) CFSTI: $3.00

The energy spectrum of the electrons registered in the Cosmos III and Cosmos V were estimated from the signal ratios of electron indicators with foils of various thicknesses for various accelerating voltages. It is shown that the contribution of electrons with energies <40 keV to the registered signal is not always uniform. The ratio of the intensity of electrons with $E<40$ keV to that of electrons with $E<40$ keV varies from 10^{-2} to 5. In the group ($E<40$ keV), the basic contribution is made by electrons with energies from 10–20 keV. Soft electrons ($E \approx 10$–20 keV) appear for the most part at small invariant altitudes. Their intensity at altitudes $\approx$1000 km over the South Atlantic was substantially lower than at analogous altitudes in the region of the Eastern Hemisphere. The maximum electron intensity in the energy range from 10–20 keV at $\approx$1500 km of altitude reached 10^7 particles/cm^2-sec-steradian, while the sensitivity threshold of the equipment corresponded to an intensity of $\approx 5 \cdot 10^5$ particles/cm^2-sec-steradian. Author

N67-20391 Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
REGISTRATION OF FRAGMENT GAMMA-RADIATION IN THE HIGH-ALTITUDE EXPLOSION OF 9 JULY 1962 OVER JOHNSTON ISLAND
Yu. V. Kikushkin and A. S. Strelkov *In its* Cosmic Res. 23 Jun. 1966 p 168–179 refs (See N67-20381 10-30) CFSTI: $3.00

It is shown on the basis of the physical pattern of cloud development from high-altitude nuclear explosions and the motion of charged γ- and β-active fission fragments trapped in the geomagnetic field that the "γ-dawn" phenomenon observed at the time of the American nuclear explosion of 9 July 1962 on the Cosmos V satellite can be accounted for by the γ-emission of fragments rising over the horizon. It is also shown in this study that the observed effect could not have been produced by the radiation of the nuclear explosion if the source was below the horizon. Author

N67-20402 Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
CASES OF TRANSITORY INCREASE IN HEAVY-NUCLEUS FLUX ACCOMPANIED BY OUTBURSTS OF X-RAY RADIATION
L. V. Kurnosova, S. L. Mandel'shtam, L. A. Razorenov, I. P. Tindo, and M. I. Fradkin *In its* Cosmic Res. 23 Jun. 1966 p 279–283 refs (See N67-20381 10-30) CFSTI: $3.00

Analyzed are data on transitory increases in the flux of nuclei with $Z \geq 15$ which were accompaneid by outbursts of X-ray radiation and which were recorded by the Elektron II instrument package on January 30 and February 14, 1964. The flux of nuclei was measured with a Cerenkov detector having an area of 5 cm^2. The X-ray radiation was registered by a Geiger photo counter which was sensitive in the region from 2 to 10Å. Readings of the two detectors at the time at which the nucleus flux rise was registered are shown. The January 31 increase in flux was registered two minutes before an outburst of x-radiation. On February 14, the flux of nuclei rose two minutes after a sharp increase in X-ray intensity. On the basis of these data it is postulated that the increases in the flux of nuclei and X-ray outbursts were registered simultaneously. The probability that these transitory increases were a result of statistical fluctuations, and the probability of the random coincidence of a rise in nucleus flux and an outburst of x-radiation, were also analyzed. Results of these analyses indicated that transitory rises are nonstatistical in nature, and the probability of registering two coincidences with the same average number is $4 \times 7 \times 10^{-3}$. On the basis of these results, it is concluded that the enhancement of the nuclei flux is related to outbursts of solar x-radiation, and that the proposed hypothesis is plausible. S.C.W.

N67-20440# Colorado Univ., Boulder.
TRANSIENT FLARE-ASSOCIATED PHENOMENA IN THE SOLAR ATMOSPHERE
Gerald F. Anderson Sep. 1966 241 p refs
(Contract Nonr-1147(13); Grants Nonr(G)-00059-64; Nonr(G)-00046-65; Nonr(G)-0025-66)
(AD-640661) CFSTI: HC $3.00/MF $0.65

Disturbances propagating from flares, as observed by high time resolutions H alpha Lockheed filtergrams, are analyzed. A theoretical model is developed, assuming a magnetohydromagnetic pulse which is generated by a source located in the flare region, propagates from the source and is refracted in the solar corona. Ray tracing calculations, when fitted to the observations, yield reasonable source heights and magnetic fields. Author (TAB)

N67-20664# Minnesota Univ., Minneapolis. Cosmic Ray Group.
ANISOTROPIC DIFFUSION OF SOLAR COSMIC RAYS
Leonard Francis Burlaga Dec. 1966 68 p refs
(CR-88; AD-643863) CFSTI: HC $3.00/MF $0.65

A mathematical model is presented and a relatively simple solution is obtained which describes the basic characteristics of solar cosmic ray propagation. The model postulates that solar cosmic rays diffuse anisotropically in the interplanetary medium because of the irregular spiral interplanetary magnetic field. TAB

N67-20703# Oslo Univ., Blindern (Norway). Inst. of Theoretical Astrophysics.
ON SOME PROPERTIES OF SOLAR STORM BURSTS IN THE 200 MC/S REGION
Hans Kr. Eckhoff May 1966 32 p refs
(Contract AF 61(052)-743)
(Rept.-18; AD-643814) CFSTI: HC $3.00/MF $0.65

More than 4000 storm bursts recorded with the swept frequency receiver at Harestua during an intense noise storm occurring in August, 1961, have been analysed. From the recordings three periods were selected for a close examination. During one of these a very remarkable change in burst duration took place. The abnormal conditions lasted for some minutes and the period is henceforth referred to as the flash-period. The mean total duration of the storm bursts occurring outside the flash period was found to be 0.43 seconds and the mean total bandwidth amounted to 5.6 Mc/s. During the flash period the mean total duration of the bursts decreased to 0.22 seconds and also the spread in burst durations diminished. No change in the distribution of burst bandwidths was found during the flash-period. Frequency drift is discussed in connection with flash-bursts and ordinary type I bursts. Many complex bursts were studied by means of an isodensitometer. As a result of this a maximum duration of 0.8 seconds was established for the bursts in the material. TAB

N67-21457*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE FEBRUARY 5, 1965 SOLAR PROTON EVENT 1: TIME HISTORY AND SPECTRUMS OBSERVED AT 1100 km
C. O. Bostrom, J. W. Kohl (APL), and D. J. Williams Jan. 1967 29 p refs
(NASA-TM-X-55728; X-611-67-22) CFSTI: HC $3.00/MF $0.65 CSCL 20H

The solar proton event of February 5, 1965 was observed in the polar regions with detectors aboard 1963 38C. The initial detection of protons occurred during the pass at 1914 UT, February 5 and the maximum intensity of 115 $cm^{-2} sec^{-1}$ for $E_p \geq 25$ MeV was seen during the pass at 2103 UT, February 5. The time history of the low energy protons ($E_p \geq 1$ to 2 MeV) was considerably more complex than that of the higher energy particles. The maximum observed intensity ($E_p \geq 2$ MeV) was equal to 775 cm^{-2} sec^{-1} at 0232 UT, February 6 and a second maximum was observed following the onset of the magnetic storm on February 6. The detailed discussion of the low energy proton behavior is taken up in the companion paper. For the higher energies the particle flux decayed approximately exponentially in time with the shorter "lifetimes" associated with the higher energies. An attempt to fit the time history with diffusion theory using a diffusion coefficient of the form $D = Mr^\beta$ was moderately successful for $E_p \geq 25$ MeV. The spectrum showed a (nearly) monotonic softening with time and a power law generally provided a better approximation to the spectrum than did an exponential form. Author

N67-21459*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE FEBRUARY 5, 1965 SOLAR PROTON EVENT 2: LOW ENERGY PROTON OBSERVATIONS AND THEIR RELATION TO THE MAGNETOSPHERE
D. J. Williams and C. O. Bostrom (APL) Jan. 1967 31 p refs
(NASA-TM-X-55729; X-611-67-23) CFSTI: HC $3.00/MF $0.65 CSCL 20H

Observations of the temporal and spatial behavior of low energy (≈ 1 MeV) solar protons are presented for the solar proton event of February 5, 1965, utilizing data from the near earth satellites 1963 38C and INJUN 4 and spaceprobe Mariner 4. An enhancement of low energy proton intensities is observed at invariant latitudes $\Lambda > 80°$ and may be a low altitude effect of the high latitude topology of the magnetopause. Comparison of the polar cap and Mariner 4 observations indicate that the magnetospheric configuration varies as the boundary conditions imposed by the interplanetary medium vary, thereby causing marked structure in the polar cap proton intensities. Further comparisons of the polar cap and Mariner 4 observations are presented and discussed in terms of (1) a filamentary interplanetary field structure and (2) an extended geomagnetic tail. It is indicated that particle motion across interplanetary field lines near the solar surface or in the region of the shock front is required to explain the low energy proton arrival times in the vicinity of the earth. Author

N67-21772# Bologna Univ. (Italy). Inst. of Physics.
COSMIC X-RAY SOURCES IN THE 20 TO 180 KeV ENERGY RANGE
D. Brini, U. Ciriegi, F. Fuligni, E. Moretti, and G. Vespignani [1966] 24 p refs
CFSTI: HC $3.00/MF $0.65

Two X-ray sources in the energy range from 20 to 180 KeV were detected in two balloon flights. Both fluxes are the same order of magnitude, about 5×10^{-8} ergs × cm^2 × s^{-1} These could be associated with the two sources already detected at lower energies Serp X1 and Cyg X2. An association of either of them with Cyg X1 is to be excluded, because an upper limit of the flux from Cyg1 may not be greater than a tenth of that of the other sources. Some energy spectra fitting the data are considered. A power law with an index of about 1.6 appears to give a good fit. The existence of X-rays of energy of many tens of keV is indicated, so excluding a black body emission mechanism. Author (ESRO)

30 SPACE SCIENCES

Includes astronomy and astrophysics; cosmology; lunar and planetary flight and exploration; and theoretical analysis of orbit and trajectory. For related information see also: 11 Facilities, Research and Support; and 31 Space Vehicles.

N67-20381 Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
COSMIC RESEARCH, VOLUME 4, NUMBER 1, 1966
23 Jun. 1966 318 p refs Transl. into ENGLISH from Kosmich. Issled. (Moscow), v. 4, no. 1, 1966 175 p
(FTD-TT-66-76; TT-66-62322; AD-639378) CFSTI: $3.00

Articles are presented pertaining to Soviet research on manned and unmanned space flights, interplanetary and transfer trajectories, atmospheric probes, scientific satellites, life support systems, space sciences, and radiation belts. For individual titles, see N67-20382 to N67-20403.

N67-20382 Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
OPTIMUM DISTRIBUTION OF CORRECTING IMPULSES IN SINGLE-PARAMETER CORRECTION
V. A. Yaroshevskiy and G. V. Parysheva *In its* Cosmic Res. 23 Jun. 1966 p 1–20 refs (See N67-20381 10-30) CFSTI: $3.00

An evaluation of the fuel expenditure on correction as a vehicle approaches the destination planet is derived for various laws of variation of the measurement errors, with and without consideration of the nonideal manner in which the correcting impulses are executed. Author

N67-20383 Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ENERGETICALLY OPTIMAL TRANSFERS FROM A HYPERBOLIC ORBIT IN THE ABSENCE OF RESTRICTIONS ON TIME FOR TRANSFER
V. V. Ivanshkin *In its* Cosmic Res. 23 Jun. 1966 p 21–34 refs (See N67-20381 10-30) CFSTI: $3.00

Transfers optimal in the sense of minimum characteristic velocity between two orbits in a central Newtonian force field are considered for the case in which one of the orbits is hyperbolic. The orientation of the orbits and the magnitude of the reaction–thrust acceleration are arbitrary. It is shown that transfer between hyperbolic orbits may be effected with the characteristic velocity as low as we please. The energy expenditures on transfer between elliptical and hyperbolic orbits are functions only of the parameters of the elliptical orbit. The mutual orientation of the orbits and the magnitude of the reaction–thrust acceleration exert no influence on the energetics of the transfer. Author

N67-20384 Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
OPTIMUM TRANSFERS BETWEEN COPLANAR ELLIPTICAL ORBITS IN A CENTRAL FIELD
V. I. Gurman *In its* Cosmic Res. 23 Jun. 1966 p 35–58 refs (See N67-20381 10-30) CFSTI: $3.00

The problem of plane optimum transfers of a point of variable mass between elliptical orbits in a central Newtonian field is investigated on the basis of the previous results with free orientation of the orbit lines of apsides. It is shown that the solution of the problem in the general case is a minimizing sequence each of whose elements consists of two systems of active segments, one of which contains powered segments in the vicinity of the pericenters, while the other contains powered segments in the vicinity of the apocenters of the osculating orbits with thrust directed along the tangent to the orbit. If the thrust is unlimited, the solutions found may be realized as two-impulse apsidal transferes. Author

N67-20385 Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
TWO MATRIX FORMS OF ESTIMATES OF SPACECRAFT MOTION PARAMETERS
V. A. Reznikov *In its* Cosmic Res. 23 Jun. 1966 p 59–70 refs (See N67-20381 10-30) CFSTI: $3.00

Problems of estimating the deviations of spacecraft motion parameters are considered, taking into account a priori information on the quantities to be estimated. Two generalized matrix forms are obtained and used as a basis for constructing a system of maximum probability estimates for the various methods of processing the measured information. Certain peculiarities of practical application of the various types of estimates are analyzed. Author

N67-20386 Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
EXPERIMENTAL INVESTIGATION OF THE NEUTRAL COMPOSITION OF THE ATMOSPHERE IN THE 100–200 km ALTITUDE REGION

A. D. Danilov *In its* Cosmic Res. 23 Jun. 1966 p 71–105 refs (See N67-20381 10-30) CFSTI: $3.00

The paper examines experimental data on the altitude variation of the atmosphere's neutral composition in the 100–200-km region. Brief consideration is given two basic methods of measurement, optical and mass-spectrometric, that are used in rocket studies of the atmospheric-component concentrations. Comparison of results from various experiments to determine the concentrations of molecular nitrogen makes it possible to obtain average values of N_2 that differ from the experimental curves by factors no larger than 1.6. It is not possible to detect seasonal or diurnal variations in the concentration of molecular nitrogen or changes linked to solar activity. An analogous study for O_2 also indicates average molecular-oxygen concentrations that show no noticeable variations within the scope of available experimental data. A dependence on the time of day (noon) is observed for the ratio of O and N_2 concentrations. Since the concentration of molecular nitrogen apparently undergoes no substantial variations, this means that O must vary. Author

N67-20387 Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE POSSIBLE ANTIMATTER NATURE OF MICROMETEORS
B. P. Konstantinov, M. M. Bredov, A. I. Belyayevskiy, and I. A. Sokolov *In its* Cosmic Res. 23 Jun. 1966 p 106–119 refs (See N67-20381 10-30) CFSTI: $3.00

The paper sets forth reflections on the possible antimatter nature of comets and stream micrometeors and presents the results of an experiment to test this hypothesis. Author

N67-20410* Virginia Univ., Charlottesville. Dept. of Astronomy
DEVELOPMENT OF TABLES FOR USE IN CELESTIAL NAVIGATION ON THE LUNAR SURFACE Final Report
David D. Meisel, Laurence W. Fredrick, and Peter J. Shelis 15 Jan. 1967 136 p refs
(Contract NASB-20274)
(NASA-CR-83050) CFSTI: HC $3.00 CSCL 17G

A computer program in the ALCOL programming language was generated which produces ephemaris and almanac data for use in celestial navigation on the lunar surface. The structure and philosphy of the resulting Lunar Astronomical Navigation System (LANS) are outlined. Although its present accuracy is not quite sufficient for surface geodetic studies, it is probably sufficient for all celestial navigation tasks. Difficulties still remain with some of the physical constants but they sould be much improved when the lunar orbiter and surveyor programs are completed. Using the LANS basic program and gravity and geoid constants, a set of tables were generated giving deflections of the vertical, the total gravity vector and the normalized geoid radius as a function of spherical longitude and latitude. Also generated was a table of the gravity and geoid pseudo-coordinates as a function of spherical longitude and latitude. R.N.A.

N67-20412*# National Aeronautics and Space Administration, Washington, D. C.
SECOND ANNUAL MEETING OF THE WORKING GROUP ON EXTRATERRESTRIAL RESOURCES
[1964] 96 p refs Rept. of Meeting held at the AF Missile Develop. Center, Holloman AFB, Alamogordo, N. M., 23–25 Oct. 1963
(NASA-TM-X-54877) CFSTI: HC $3.00/MF $0.65 CSCL 03B

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12. RECENT OBSERVATIONS OF THE MARTIAN ATMOSPHERE BY SPINRAD, MUUNCH AND KAPLAN Leonard Jaffe (Jet Propulsion Lab.) p 89–91

N67-20414*# Army Corps of Engineers, Washington, D. C.
LUNAR CONSTRUCTION RESEARCH
Bruce M. Hall *In* NASA 2d Ann. Meeting of the Working Group on Extraterrest. Resources [1964] p 24–32 refs (See N67-20412 10-30) CFSTI: HC $3.00/MF $0.65

The results of three major engineering studies on lunar habitation are summarized and their directive influence on the character of lunar base design and construction is analyzed. The studies involve an analysis of the research and experimental effort required to develop a lunar construction capability along with implementation plans, an analysis of the engineering test requirements for an Apollo logistic support system, and a study to develop an initial concept for a lunar base. R.N.A.

N67-20415*# Sperry Utah Co., Salt Lake City, Utah.
TIME-PHASING OF LUNAR EVENTS
H. M. Segal *In* NASA 2d Ann. Meeting of the Working Group on Extraterrest. Resources [1964] p 33–44 refs (See N67-20412 10-30) CFSTI: HC $3.00/MF $0.65

An approach is described for preparing a master plan for the time phasing of extraterrestrial resources into extraterrestrial systems. The approach involves three steps which show that there will be a logistic savings, that a lunar facility is realistic and not just a result of academic speculations, and that an investment in a lunar facility will produce a substantial return. R.N.A.

N67-20416*# Air Force Cambridge Research Labs., Bedford, Mass. Lunar–Planetary Research Branch.
REMOTE DETECTION OF LUNAR WATER DEPOSITS
Roger A. Van Tassel and John W. Salisbury *In* NASA 2d Ann. Meeting of the Working Group on Extraterrest. Resources [1964] p 45–56 refs (See N67-20412 10-30) CFSTI: HC $3.00/MF $0.65

Consideration is given to the first step in establishing a lunar refueling station, the detection of water deposits. Because of

the hostile lunar environment and the large surface area to be explored, it appears that economical water detection must be done by scanning the surface remotely from a lunar satellite or even from the earth. Several possible remote sensing techniques to aid in water detection are reviewed. These include radio wave, infrared, visible, ultraviolet, and X-ray techniques. The examination of these different water detection techniques suggests that measurement of infrared emission is the most promising because it is the least ambiguous. Two examples of rock alternation are described which illustrate that infrared emission can detect lunar water deposits either through a change in grainsize, or a change in composition, or both. These anomalies, especially when associated with geological features of probable internal origin such as chain craters, can be used as strong indicators of water deposits. R.N.A.

N67-20417*# Little (Arthur D.), Inc., Cambridge, Mass.
WATER EXTRACTION IN THE LUNAR ENVIRONMENT
Alfred E. Wechsler, Peter E. Glaser, and John W. Salisbury (AFCRL) *In* NASA 2d Ann. Meeting of the Working Group on Extraterrest. Resources [1964] p 57–68 refs (See N67-20412 10-30) CFSTI: HC $3.00/MF $0.65

Several processes suitable for water extraction in the lunar environment are described. Their advantages and disadvantages are discussed from an engineering viewpoint, and the direction that research and development effort should take to insure successful utilization of lunar water resources is indicated. There is evidence which indicates that lunar water is present in the form of ice or hydrated minerals. Solar or nuclear energy sources can provide the necessary energy to extract the lunar water. Surface and easily mined deposits will be more useful for water extraction processes in the initial stages of lunar recourse development. Processes using kilns, furnaces, and fluid beds are easily adaptable for lunar water extraction. R.N.A.

N67-20419*# North American Aviation, Inc., Downey, Calif.
EXTRATERRESTRIAL RESOURCES IN LIFE SUPPORT SYSTEMS
H. M. Conrad and S. P. Johnson *In* NASA 2d Ann. Meeting of the Working Group on Extraterrest. Resources [1964] p 75–83 refs (See N67-20412 10-30) CFSTI: HC $3.00/MF $0.65

The use of indigenous lunar materials for food, water, livable atmosphere, and waste management subsystems in life support systems is discussed. For reasons of economy, the subsystem requirements are believed to be best satisfied by a semi-closed ecological system The semi-closed ecological system comprises several integral subsystems including a crew, a water reclamation and purification unit, a waste disposal unit, an algal subsystem, a high plant unit, a small animal colony for meat production, and a physico-chemical environment control system. An integrated extraction device using a solar-nuclear-plasmatron train for extracting useful compounds from lunar rocks is shown and discussed. Hardware items, which can be made by liquifying and molding lunar basalts using a nuclear power heat source, are listed. Current concepts for the modular development of a lunar base are illustrated and discussed along with an example of an early incorporation of biological systems into the life support module, and the algal system incorporated into the partial biological life support system. A chemical analysis of lunar type rock constituents indicates that when properly enriched with nitrogen they can support the growth of green plants. R.N.A.

N67-20492# Liege Univ. (Belgium). Dept. of Astrophysics.
A TABLE OF THE SOLAR SPECTRUM FROM λ7498 TO λ12016
J. W. Swensson, G. Roland, W. S. Benedict (Johns Hopkins Univ.), O. C. Mohler (Michigan Univ., Ann Arbor), and L. Delbouille *In its* Celestial Spectra and Atmospheric Effects Mainly in the Infrared 31 May 1966 29 p refs (See N67-20489 10-13) CFSTI: HC $3.00/MF $0.65

Intended as a description of numerous photometric records obtained with a high-resolution prism-grating spectrometer, a table of the solar spectrum from λ 7498 to λ 12016 is presented. The spectrum in this region reveals about 10450 solar and telluric absorption lines. In the preparation of this table, the aim was to present as complete information as practicable in concise form concerning the spectral lines and their identification. Included are data for detailed identification of the energy levels entering into the transitions, as well as laboratory measurements of the corresponding lines. R.Ll.

N67-20565# Texas Univ., Austin.
RELATIVISTIC COSMOLOGY
E. L. Schuecking 1966 13 p ref Repr. from J. Att Conv Sulla Cosmologia, 1966 p 3–11
(Grant AF-AFOSR-453-63)
(AFOSR-66-2082; AD-642885) CFSTI: HC $3.00/MF $0.65

The paper concerns a general discussion of cosmological models. Such models as the Friedmann and Bianchi are discussed in rather general terms. Author (TAB)

N67-20647# Aeronautical Chart and Information Center, St. Louis, Mo.
SPACE REFERENCE SYSTEMS
William T. Riordan Apr. 1966 66 p refs
(ACIC-TR-98; AD-644222) CFSTI: HC $3.00/MF $0.65

The various space reference systems, applicable to the specification of positions and motions of objects in the solar system, are discussed according to their origin. Geocentric, topocentric, selenocentric, heliocentric, planetocentric, barycentric, orbit plane, vehicle-centered, galactic and geomagnetic systems are included. The various fundamental planes and principal directions used with each system are described, where possible. The uses of the system are indicated. The transformations relating one system to another and the errors inherent both in the specifications of the positions and in the carrying out of the transformations are examined in detail. Author

N67-21021*# National Aeronautics and Space Administration, Washington, D. C.
REPORT TO THE SPACE SCIENCE BOARD ON THE SPACE SCIENCE AND APPLICATIONS PROGRAMS
Nov. 1966 189 p refs
(NASA-TM-X-59454) CFSTI: HC $3.00/MF $0.65 CSCL 22A

The major satellite and space probe firings since 1958, carried out in connection with the Office of Space Science Applications, are briefly detailed and plans for forthcoming missions are described for lunar, planetary, and biological satellites. Space applications are outlined for communications, earth resources, geodesy, meteorology, sounding rockets, and navigational purposes. The Apollo Project manned space flight future missions are highlighted. A list is presented of the university programs conducted in coorperation with NASA, and summary costs of launched spacecraft are indicated. R.Ll.

N67-21056# Royal Aircraft Establishment, Farnborough (England).
RESONANCE EFFECTS DUE TO THE LONGITUDE DEPENDENCE OF THE GRAVITATIONAL FIELD OF A ROTATING PRIMARY
R. R. Allan Aug. 1966 41 p refs
(RAE-TR-66279) CFSTI: HC $3.00/MF $0.65

There will be long-period oscillations in the position of a satellite if its path is nearly repetitive relative to the rotating primary, and there is an infinite sequence of such resonances. The

behavior near resonance is governed by a pendulum equation and in the extreme case a satellite can be captured by the resonance and be stable against small drag forces. Moreover the presence of drag forces, which include a change in the primary's rotation, e.g. by tidal effects, gives a mechanism for permanent or semi-permanent capture, a positive real drag or its equivalent being the more favorable condition. The capture takes place, drag forces lead to secular changes in inclination; the sense depends on the sign of the drag, whether the resonance is above or below synchronous height, and on the inclination itself. The resonance effects are highly dependent on inclination, and all except the synchronous resonance become ineffective on the equatorial plane. This appears to give a partial explanation of the formation and structure of the rings of Saturn, and suggests that there could be similar but much less regular bands of dust around the earth. Author

N67-21057# *Royal Aircraft Establishment, Farnborough (England).*
THE ORBITAL ELEMENTS OF COSMOS 5 NEAR THE BEGINNING AND END OF ITS LIFE
H. Hiller Aug. 1966 12 p refs
(RAE-TR-66258) CFSTI: HC $3.00/MF $0.65

The orbit-improvement program was used to determine the orbital elements of Cosmos 5 (1962 ν 1) near the beginning and end of its life in orbit. About 250 observations were used in the analysis, of which 80 were rejected as unsuitable. It was found that the orbital inclinations were not all accurate enough to give a reliable value for the rotational speed of the atmosphere, which was the main purpose of this study. Better results would have been obtained had some good Southern-Hemisphere observations been available. Author

N67-21175*# Lincoln Lab., Mass. Inst. of Tech., Lexington.
RADAR STUDIES OF THE MOON Quarterly Progress Report No. 1
28 Feb. 1967 24 p refs
(Contract NSR-22-009-106)
(NASA-CR-83121) CFSTI: HC $3.00/MF $0.65 CSCL 03A

Details are given on continuing work on radar studies of the moon, including unambiguous coherent radar mapping at 23 cm, high-resolution 3.8-cm reflectivity mapping, and progress in an 8-mm radar system. Some of the basic principles of the unambiguous coherent radar mapping method are reviewed, and the various choices of parameters to be used are discussed. A computer program, developed to produce two-dimensional maps is described. Some observations that have been made are discussed, and a coarse resolution contour map of the whole lunar disk, obtained at 23 cm, is given. Progress in delay-Doppler mapping at 3.8 cm is reported. It is pointed out that difficulties with the data analysis have been overcome and a number of radar reflectivity maps have been produced, some of which are shown and discussed. Finally, development of the 8-mm radar system is covered, with emphasis placed on progress on the transmitter. . . L.E.W.

N67-21180*# Jet Propulsion Lab., Calif. Inst. of Tech. Pasadena.
THE MARS 1964–1965 APPARITION
C. F. Capen 15 Dec. 1966 204 p refs
(Contract NAS7-100)
(NASA-CR-83123; JPL-TR-32-990) CFSTI: HC $3.00/MF $0.65 CSCL 03A

A multicolor photographic and visual patrol of the planet Mars was carried out for an entire terrestrial year that covered the Martian northern hemisphere spring and summer during the 1964–1965 apparition. The spectral range of the photographic program included the ultraviolet, visual, and infrared in seven discrete pass-bands. The nightly visual record was obtained with the aid of six color filters spaced across the visual spectrum. Good observational coverage was obtained of the Mariner IV scan region (110°–200° long.) before, during, and after the photographic contact of July 15, 1965 UT, in an effort to predict and describe atmospheric and surface conditions during encounter. A summary of Martian seasonal events is given. Martian polar regions are explored and North Polar Cap regression curves obtained from orange–red and green plate measurements are presented. Atmospheric and meteorological observations are thoroughly analyzed. A daily observation report of surface conditions and atmospheric phenomena, a Mars pictorial atlas, and Mariner IV photographic data are presented. Author

N67-21431# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE PATH TO THE STARS. COLLECTION OF SCIENCE-FICTION WORKS.
K. E. Tsiolkovsky 21 Nov. 1966 463 p refs Transl. into ENGLISH of the book "Put'k Zvezdam. Sbornik Nauchno-Fantasticheskikh Proizvedeniy" Moscow, Izdamelosmvo Akad. Nauk SSSR, 1960 p 1–360
(FTD-MT-64-243; AD-644808) CFSTI: HC $3.00/MF $0.65

The article is a collection of science fiction works and a number of propositions by the Russian author, K. E. Tsiolkovsky. Many of his ideas and propositions have proven to be inaccurate, but nevertheless he did accurately describe some possibilities of the space environment as we know it today. He proposed that the absence of gravity facilitates work, and this relieves the pain of the aged and the ill. He proposed the use of a special green house for supplying food and the restoration of wastes into usable air and water. All necessary energy was to be obtained by mirrors from the suns rays, which Tsiolkovsky thought were being wasted for the most part. He gives an adequately accurate description of the moons landscape, but he is presupposing too much in the description of native life on the moon and other planets, especially without an atmosphere, and the ease with which gravity is defied. Tsiolkovsky also underestimated some suppositions about the acceleration force in the absence of gravity and the danger of meteorite collision. He overestimated the possibility of using a liquid medium for reducing g forces on man during acceleration and the possibility of catching meteorites with nets as one would catch butterflies. Some other improbable conceptions of his are the underestimation of using mirrors to create temperature increases at great distances from the sun, the assumption that all starts have planetary systems, migrations to other planets is a necessity, the estimation of the suns cooling and destroying the Earth, forcing humanity to find another home by migration to other planets. Despite his inaccurate assumptions, his articles are of value. TAB

N67-21443*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
MISSION TO A COMET: PRELIMINARY SCIENTIFIC OBJECTIVES AND EXPERIMENTS FOR USE IN ADVANCED MISSION STUDIES
Roy G. Brereton, Ray L. Newburn, Charles E. Giffin, Marcia M. Neugebauer, Edward J. Smith et al 15 Feb. 1967 27 p refs
(Contract NAS7-100)
(NASA-CR-83113; JPL-TM-33-297) CFSTI: HC $3.00/MF $0.65 CSCL 22B

Several possible scientific objectives for a comet mission, with their supporting experiments, are described. Background scientific information is also provided. An Atlas/Centaur launch vehicle is assumed, as is also a spacecraft–comet encounter, with a miss distance of less than 2500 km. A select list of scientific experiments on board an intercept probe of this type can be expected to provide data towards a major advance in our understanding of comets. It is the thesis of this report that a space-probe to a comet may be potentially the most important mission for purposes of cosmogonical research that will be within the capabilities of the early 1970's. Author

N67-21449*# Boeing Co., Seattle, Wash.
LUNAR ORBITER I. PHOTOGRAPHIC MISSION SUMMARY
Washington, NASA, Apr. 1967 85 p
(Contract NAS1-3800)
(NASA-CR-782) CFSTI: HC $3.00/MF $0.65 CSCL 22B

Readout and evaluation of a series of 20 photos taken by the first Lunar Orbiter spacecraft of Mare Smythii showed that the moderate resolution photos were satisfactory while the high resolution photos contained smeared images caused by electrical transients tripping the focal-plane shutter prematurely. In addition, photos were taken from the far side of the moon, scientific areas on the front side, as well as Earth pictures seen from the Moon. Film processing was completed and the readout of all photos initiated. G.G.

N67-21458* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ON THE PERTURBATIONS OF SMALL ECCENTRICITY SATELLITES
Theodore L. Felsentreger and Ellen L. Steinberg Mar. 1967 22 p refs
(NASA-TM-X-55730; X-547-67-102) CFSTI: $3.00 CSCL 22C

For small eccentricity satellites, so-called "first-order" orbit theories actually contain errors of the first order by neglecting J_2, etc. terms having eccentricity as a divisor. These terms appear in the expressions representing the perturbations in eccentricity, mean anomaly, and argument of perigee. Using the von Zeipel method, terms of this sort through J_2 and $(J_1/J_2)^3$, J_1 being any odd zonal harmonic coefficient, are presented here. Amplitudes of the terms for the satellites Alouette 1 and Tiros 8 are given. In addition, it is shown that these "small divisor" terms produce no in-track, along-track, or cross-track errors. Author

31 SPACE VEHICLES

Includes launch vehicles; manned space capsules; clustered and multistage rockets; satellites; sounding rockets and probes; and operating problems. For basic research see: 30 Space Sciences. For related information see also: 28 Propulsion Systems; and 32 Structural Mechanics.

N67-20556# Metrophysics, Inc., Santa Barbara, Calif.
DESIGN, DEVELOPMENT AND FLIGHT TESTING OF AN INSTRUMENTED TRANSPONDER DART Final Report, Jul. 1965–Oct. 1966
Frank J. Hayo Oct. 1966 67 p
(Contract AF 19(628)-5112)
(Rept.-7003-1; AFCRL-66-721; AD-643430) CFSTI: HC $3.00/MF $0.65

The dart was designed for measuring vertical winds and temperature profiles over an altitude range of 200,000 - 70,000 feet, and to be compatible with an AN/GMD-4 system not requiring radar support. The dart is propelled by a Loki-type rocket to above 200,000 feet altitude. At apogee and transponder instrument is ejected and descends on a parachute, measuring temperature and wind. Flight tests conducted at White Sands Missile Range proved the feasibility of this system with 5 transponder instruments measuring the slant range successfully. Author (TAB)

N67-21219*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
AN ANALYSIS OF THE PERFORMANCE AND SPACE STORAGE CHARACTERISTICS OF SMALL PROPANE-FLOX UPPER STAGES
Harold H. Valentine, David A. Turner, and Jon C. Oglebay 1967 33 p refs
(NASA-TM-X-52280) CFSTI: HC $3.00/MF $0.65 CSCL 22D

The use of hydrogen in rocket stages poses a significant insulation problem for missions involving space storage times greater than a few hours. There is a great lack of information regarding both the distribution of incoming heat in a hydrogen tank in zero g and the weight penalties associated with zero g propellant venting devices for low coast missions. The purpose of this study was to examine one such combination propane-flox, for use in a multipurpose upper stage in order to determine its space storage characteristics and payload capability, and compare its performance capability with that of other propellant combinations. The results indicate that it is possible to design a propane-flox stage having a long space storage (no vent) capability. The performance of such a stage, however, is inferior to hydrogen fueled stages for high energy, short coast missions. For long coast low energy missions, specifically the Mars orbiter mission, the propane-flox stage displayed only a small performance advantage over an earth storable stage. Author

N67-21334# White Sands Missile Range, N. Mex. Atmospheric Sciences Lab.
A NOMOGRAM FOR FIELD DETERMINATION OF LAUNCHER ANGLES FOR UNGUIDED ROCKETS
Bernard F. Engebos and Louis D. Duncan Oct. 1966 23 p refs
(ECOM-5088; AD-644819) CFSTI: HC $3.00/MF $0.65

The construction of a nomogram to determine the launcher settings necessary to obtain a theoretical impact for an unguided rocket is discussed. The fact that the rocket will deviate from its nominal course because of the wind it encounters is taken into account. The nomogram presents a four-dimensional graph of launcher settings as functions of the theoretical wind displacements. This plot is easy to use in field operations. Author (TAB)

N67-21396*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
PAYLOAD AND TRAJECTORY DATA FOR GSFC NIKE APACHE FIRINGS JANUARY–JUNE 1965 TRACKED BY RADAR
Howard L. Galloway, Jr. and Kathleen M. Maxen (Fairchild Hiller Corp.) Feb. 1967 364 p
(NASA-TM-X-55723; X-721-67-51) CFSTI: HC $3.00/MF $0.65 CSCL 22B

Launch and payload data are presented for the Nike Apache two-stage solid propellant unguided sounding rocket. Of 65 Nike Apaches fired from January to June 1965, 47 were tracked by radar. The figures consist of a photograph or sketch of the payload configuration of each rocket tracked, followed by its radar plots. The four standared drag configurations of Nike Apaches are also depicted. S.P.

N67-21399*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
PAYLOAD AND TRAJECTORY DATA FOR GSFC NIKE APACHE FIRINGS JULY THROUGH DECEMBER 1965 TRACKED BY RADAR
Howard L. Galloway, Jr. and Kathleen M. Maxen (Fairchild Hiller Corp.) Mar. 1967 73 p
(NASA-TM-X-55726; X-721-67-103) CFSTI: HC $3.00/MF $0.65 CSCL 22B

The Nike Apache, a two-stage solid-propellant unguided sounding rocket, is stabilized by four fins (on each of the two stages) arranged in a cruciform configuraton A conical transition section bolted to the first stage slip-fits into the nozzle of the second stage. At first-stage burnout, differential drag forces separate

the stages as no mechanical restraint in the axial direction exists between the second stage and the transition assembly. Second-stage ignition is normally delayed for 16.5 seconds after first-stage burnout in order to reduce aerodynamic heating and drag in the low Altitude, high-density region. Of 28 Nike Apaches fired by Goddard Space Flight Center from July through December 1965, 9 were tracked by radar. Payload and launch data for these rockets are listed. The four standard drag configuration of Nike Apache used by GSFC is tabulated. Many payloads, however, do not conform to the standard. A photograph of the payload configuration of each rocket tracked by radar is given followed by its radar plots. Also, a sketch of Nike Apache 14.78 UA, flown from White Sands, New Mexico which did not conform to any of the standard configurations is also given. Author

N67-21426* Boeing Co., Seattle, Wash. Space Div.
STUDY OF APPLICABILITY OF LUNAR ORBITER SUBSYSTEMS TO PLANETARY ORBITERS
15 Mar. 1967 442 p
(Contract NAS1-6689)
(NASA-CR-66302; D2-100710-2) CFSTI: $3.00 CSCL 22B

Purpose of the study was to: (1) investigate the feasibility of utilizing Lunar Orbiter subsystems for Mars and Venus orbiter missions; (2) analyze the resultant spacecraft, launch vehicle, and shroud configurations in regard to performance, implementation, and cost; and (3) define any new elements required to accomplish an orbiter for Mars and Venus missions. The present volume covers the technical portions of the study and includes system level studies of the applicable missions to Mars and Venus, launch vehicle requirements, detail analysis of subsystem requirements, and a reliability assessment of the subsystems selected for the missions. K.W.

N67-21448* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
USE OF RANGER FLIGHT DATA IN THE SYNTHESIS OF A TORSIONAL ACCELERATION TRANSIENT FOR SURVEYOR VIBRATION QUALIFICATION TESTING
Marc R. Trubert 19 Apr. 1966 34 p refs
(Contract NAS7-100)
(NASA-CR-83110; JPL-TM-33-237) CFSTI: $3.00 CSCL 22B

This Technical Memorandum presents a method for the prediction of a flight acceleration at the base of spacecraft in boost configuration from the flight data of another spacecraft using the same first-stage booster. The predicted acceleration furnishes a rational basis for the vibration specifications of the spacecraft. The method is illustrated with the torsional acceleration of the *Ranger* and *Surveyor* spacecraft. The study was made in three steps: In Step I, the pulsating transient accleration, recorded at the base of *Ranger* during FLIGHTS VI through IX (booster engine cutoff event), was analyzed. A pulse type torque at the gimbal blocks of the *Atlas* engine was assumed to be cause of the transient acceleration and was determined on an analog computer. In Step II, this torque was applied on an analog model of the *Atlas/Centaur/Surveyor* vehicle; the corresponding acceleration at the base of Surveyor was deduced. In Step III, the attention was focused on the implementation of the pulse test program. In addition, recommendation for a sine sweep test was made by deriving a sine level that is equivalent to the pulses. Author

32 STRUCTURAL MECHANICS

Includes structural element design and weight analysis; fatigue; thermal stress; impact phenomena; vibration; flutter; inflatable structures; and structural tests. For related information see also: 17 Materials, Metallic; and 18 Materials, Nonmetallic.

N67-20411*# Stanford Univ., Calif. Depart. of Materials Science.
A THEORETICAL INVESTIGATION OF DISLOCATION DISTRIBUTIONS IN TWO-PHASE SYSTEMS
David Morton Barnett (Ph.D. Thesis) Mar. 1967 212 p refs
(Grant NsG-622)
(NASA-CR-83048; SU-DMS-67-7) CFSTI: HC $3.00/MF $0.65 CSCL 20K

The interactions between dispersed second phase particles or inclusions and slip dislocations exert a large influence upon the strength and ductility of crystalline solids. The effects of second phase size and rigidity upon the stresses associated with blocked dislocation arrays are examined. Using the method of continuously distributed dislocations, exact analytical solutions are obtained for the stress fields associated with screw dislocation pileups at a rigid circular inclusion, at a semi-infinite second phase of finite rigidity; and at a circular inclusion of finite rigidity. The results are used to discuss relaxation of the pileup stresses by fracture initiation in the second phase and by cross-slip of the leading array dislocations around the second phase. Fracture initiation in a second phase which is harder than the matrix ($G_2 > G_1$) can only be predicted by an atomistic modification of the Griffith–Irwin–Stroh criterion used in single phase elasticity. Cross-slip should be the more favorable relaxation mode when $L/R > 2$, and fracture initiation should be possible only when $L/R > 2$. In typical two-phase systems this analysis predicts that fracture initiation in the second phase should be possible only when the inclusion diameter is greater than about one micron. Author

N67-20548# ARO, Inc., Arnold Air Force Station, Tenn.
BUCKLING OF HEADS, CYLINDERS, AND RINGS
Kenneth P. Buchart Arnold Eng. Develop. Center, Dec. 1966 21 p refs
(Contract AF 40(600)-1200)
(AEDC-TR-66-224; AD-643908) CFSTI: HC $3.00/MF $0.65

The purpose of this report is to briefly review and summarize the research that has been accomplished on the buckling of shells and to develop practical methods of stability analyses that are applicable to large fabricated shell construction. The analyses are applicable to doubly curved shells (i.e., spheres, ellipsoids, dished heads, etc.), to stiffened and unstiffened cylinders, and to rings. Although the methods presented were specifically developed in the analysis of the Mark I - Aerospace Environmental Facility, they may be used to analyze the general class of shells constructed by the Heavy Plate Fabricators. This general type of shell is fabricated in steel or aluminum, is relatively thick, has a relatively large radius of curvature, and is fabricated generally in accordance with the ASME-Section VIII-Unfired Pressure Vessel Code. Although the loading is basically caused by external pressure, such loadings as temperature variations and concentrated loads and moments are considered. The important effects of fabrication tolerances are also considered in the analyses. TAB

N67-20662# Wichita State Univ., Kansas. Dept. of Aeronautical Engineering.
AN ANALYSIS OF AN INTEGRALLY STIFFENED PANEL Final Report
Everett L. Cook Oct. 1966 133 p refs
(Grant DA-ARO(D)-31-124-G482)
(AR-66-6; AROD-4451-2; AD-642507) CFSTI: HC $3.00/MF $0.65

An investigation was made: (1) To design and test an integrally stiffened rectangular shear panel. (2) To develop analytical procedures for shear panels subjected to thermomechanical loading, and (3) To compare the analytical and experimental results to evaluate the accuracy of the analysis methods. The body of the report presents a summary description of the methods of analysis which were investigated, the design of the test panel, the experimental program and the analytical and experimental results.

The details of the analysis methods and the digital computer programs developed to implement the use of these methods on the test panel are given in the appendices. Author (TAB)

N67-20583# California Univ., Berkeley. Div. of Applied Mechanics.

A THERMODYNAMIC DEVELOPMENT OF ELASTIC–PLASTIC CONTINUA

A. E. Green and P. M. Naghdi Jul. 1966 31 p refs

(Contract Nonr-222(69))

(AM-66-10; AD-642132) CFSTI: HC $3.00/MF $0.65

A general thermodynamical development of elastic-plastic continua for non-polar media is presented in which the plastic strain is not necessarily a symmetric tensor. Alternative, but entirely equivalent, developments of the theory are outlined and some special cases are discussed. Author (TAB)

N67-20572# Northrop Corp., Hawthorne, Calif. Norair Div.

DYNAMIC RESPONSE OF CURVED COMPOSITE PANELS IN A THERMAL ENVIRONMENT

Marcus J. Jacobson and Michael L. Wenner Nov. 1966 82 p refs

(Contract AF 49(638)-1683)

(NOR-66-336; AFOSR-66-2647; AD-642941) CFSTI: HC $3.00/MF $0.65

In order to obtain a simplified vibration theory for curved sandwich plates in a thermal environment, differential equations are derived from a small deflection Donnell-type theory for the displacements of shallow cylindrically curved sandwich panels, e.g., honeycomb panels, with thin isotropic facings. It is assumed that normals to the undeformed middle surface remain straight lines but not necessarily normal to the deformed middle surface and that the transverse deflection does not vary through the thickness. The facings may be of different thicknesses and at different temperature levels. The plates may be subjected to a spatially uniform lateral pressure and in-plane loads. The lateral loading may be either harmonic or random in time. It is assumed that the bending is taken only by the facings and the transverse shear stresses only by the core, which may be orthotropic. Viscous damping is assumed. The differential equations are solved for the case of simply supported boundary conditions. A computer program was developed for the free and forced vibration cases for honeycomb panels. In free vibration, natural frequencies and model shapes are predicted. In harmonic and in random forced vibrations, the deflections and stresses resulting from the flexure caused by the dynamic lateral loading in the presence of static in-plane loads are predicted. For extremely large radii, the results from the computer program are applicable to flat sandwich plates. Author (TAB)

N67-20583# Stanford Univ., Calif. Dept. of Aeronautics and Astronautics.

PERTURBATION SOLUTIONS FOR THE BUCKLING PROBLEM OF AXIALLY COMPRESSED THIN CYLINDRICAL SHELLS

Clive L. Dym and Nicholas J. Hoff Jul. 1966 67 p refs

(Contract AF 49(638)-1276)

(SUDAAR-282; AFOSR-66-1755; AD-642939) CFSTI: HC $3.00/MF $0.65

A study is made of the effect of initial deviations on the load carrying capacity of thin circular cylindrical shells under uniform axial compression. A perturbation expansion is used to reduce the nonlinear equations of von Karman-Donnell to an infinite set of linear equations, of which only the first few need be solved to obtain a reasonable accurate solution. The results for both infinite shells and shells of finite length indicate that a small imperfection can sharply reduce the maximum load that a thin-walled cylinder will sustain. In addition, for a particular set of boundary conditions, it is shown that the effect of the length for a finite shell, is small. Author (TAB)

N67-20619# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

NATURAL OSCILLATIONS AND STABILITY OF CONTINUOUS TRIPLE-LAYER PLATES WITH LIGHT FILLER

Yu. V. Krasnobayev 5 Oct. 1966 7 p refs Transl. into ENGLISH from Dopovidi Akad. Nauk Ukr. RSR (Kiev), no. 3, 1965 p 314–317

(FTD-HT-66-285; AD-643928) CFSTI: HC $3.00/MF $0.65

The article considers natural oscillations and stability of continuous rectangular plates with a light filler with different thicknesses of the layers and a constant magnitude of 2n sub i + t sub i(i = 1, 2, 3, ... n). An equation is obtained for the natural-vibration frequency and the critical load for continuous three-layer plates with their long edges supported and the short edges arbitrarily fixed. Author (TAB)

N67-20621# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

A BOUNDARY PROBLEM CONNECTED WITH THE CALCULATION OF A PRISMATIC ELASTIC SHELL OF VARIABLE THICKNESS

Jalal Kasymov 23 Sep. 1966 26 p refs Transl. into ENGLISH from Uch. Zap. Azerb. Gos. Univ., Ser. Fiz.-Mat. i Khim. Nauk (Baku), no. 7, 1956 p 3–21

(FTD-TT-65-1800; TT-67-60295; AD-644001) CFSTI: HC $3.00/MF $0.65

The article lists briefly the basic propositions of the mathematical theory of elasticity, and elucidates the mathematical difficulties connected with the calculation of shells. Using the method proposed by Professor I. N. Vekua, a system of equations is set up which characterizes approximately the stressed state of a prismatic elastic shell of variable thickness. This system of equations can be reduced, for the zero approximation, to the treatment of a boundary problem: in some connected region S bounded by a smooth contour L. This problem can be divided into two boundary problems, one of which can be solved in the usual manner using Greens function for the Laplacian operator. The other problem can be solved by means of matrix-vector notation and, by applying Greens tensor, can be reduced to an integrodifferential equation in matrix-vector form. Finally, by integrating them by parts, the final equations are reduced to a system of integral equations of the Fredholm type. TAB

N67-20637# David Taylor Model Basin, Washington, D. C.

A NEW METHOD FOR SOLVING TECHNICAL EIGENVALUE PROBLEMS [EIN NEUES VERFAHREN ZUR LOESUNG TECHNISCHER EIGENWERTPROBLEME]

R. Grammel Oct. 1966 24 p ref Transl. into ENGLISH from Ing.-Archiv (Berlin), v. 10, 1939

(DTMB-TRANS-335; TT-67-60145; AD-643279) CFSTI: HC $3.00/MF $0.65

A new method is developed for obtaining improved (that is, lower) upper bounds to technical eigenvalue problems occurring in mathematical physics. The method is a sort of counterpart to the well-known mathematical techniques of Lord Rayleigh, Ritz, and Galerkin for getting approximate solutions to vibration frequencies and buckling loads. The underlying principle for this new method has come to be known as the Principle of Minimum Complementary Energy vis-a-vis the Principle of Minimum Potential Energy underlying the methods of Rayleigh and Ritz. A numerical example of practical interest is worked out to illustrate the improved results of the new method. Author (TAB)

N67-20659# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

METHODS OF INVESTIGATING THE STABILITY OF LONGITUDINALLY CORRUGATED CYLINDRICAL SHELLS

H. L. Komisarova 27 Jun. 1966 7 p refs Transl. into ENGLISH from Dopovidi Akad. Nauk Ukr. RSR (Kiev), no. 1, 1965 p 33–36

(FTD-TT-65-1947; TT-67-60254; AD-643728) CFSTI: HC $3.00/MF $0.65

The stability of a longitudinally corrugated cylindrical shell, compressed by longitudinal forces uniformly distributed over its fronts was investigated. The theory of equilibrium of thin walled rods was applied for the purpose of dividing the shell into rods. It was shown that the reaction forces between the mentioned rods affect the value of the critical load. TAB

N67-20718# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

APPROXIMATE CALCULATIONS OF ELASTIC–PLASTIC THIN SHELL THEORY

Tsen-ti Chou 8 Sep. 1966 20 p refs Transl. into ENGLISH from Li Hsueh Hsueh Pao (Communist China), v. 7, no. 1, 1964 p 1–11

(FTD-TT-65-1828; AD-643970) CFSTI: HC $3.00/MF $0.65

In this paper the energy method was employed to analyze the elastic-plastic deformation of thin sheels of linear hardening materials. The strain energy is calculated by using the method elastic energy together with a reduced plastic energy, and the problem becomes an elasticity problem together with an ideal plasticity problem. The problem of a circular cylindrical shell loaded symmetrically with respect to its axis was also calculated. Results are in agreement with those of A.A. Ilyushin. Utilizing this method, a considerably simpler calculation formula was obtained which describes the case of plastic deformation. Thus the calculation work is drastically reduced and the mechanical conception is also relatively easy to understand; hence, this method is easy to apply to other cases. Author (TAB)

N67-20726# ARO, Inc., Arnold Air Force Station, Tenn.

METHOD FOR DETERMINING BUCKLING LOADS OF CIRCULAR STIFFENING RINGS, INCLUDING CONSIDERATION OF TORSIONAL DISPLACEMENT

Larry E. Farmer Arnold Eng. Develop. Center, Dec. 1966 33 p refs

(Contract AF 40(600)-1200)

(AEDC-TR-66-188; AD-643878) CFSTI: HC $3.00/MF $0.65

A solution for the buckling loads of free rings is incorporated into an elementary analysis of ring-cylindrical shell interaction to obtain a method for computing external shell pressures which result in instability of stiffening rings. The method developed includes torsional as well as radial stability in the rings. Shell restraint of the rings is assumed only in the direction of the shell axis at the ring-shell intersection. It is shown that torsional and in-plane buckling are independent for rings which have cross-sectional symmetry about their diametral plane. Two example problems are shown. TAB

N67-20758# Oak Ridge National Lab., Tenn.

COMPARISON OF THEORETICAL AND EXPERIMENTAL STRESSES ON A SPHERICAL SHELL WITH A SINGLE RADIALLY ATTACHED NOZZLE

F. J. Witt, R. C. Gwaltney, and B. L. Greenstreet Nov. 1966 41 p refs

(Contract W-7405-ENG-26)

(ORNL-TM-1634) CFSTI: HC $3.00/MF $0.65

The stresses on a series of steel spherical-shell models with single nozzles radially attached were examined with strain gages. The parameters studied were nozzle dimensions and length of internal nozzle protrusions. The loads were internal pressure on the shell and nozzle and axial thrust and moment loadings on the nozzle. Both experimental and theoretical stresses are reported for six configurations for which the sphere dimensions were equal for six configurations for which the sphere dimensions were equal and the outside diameter of the attached nozzle was constant. In most instances the nozzle protruded through the vessel. Empirical design data were obtained and the adequacy of theroretical methods assessed. The most significant conclusion is that for each configuration and all loadings the maximum experimental stresses are well approximated by the theoretical analyses. The approximations improved for the thinner nozzles. The theoretical stress distributions also agreed quite well in general with those obtained experimentally. Author (NSA)

N67-20862# Southwest Research Inst. San Antonio, Tex.

STUDIES OF THE FATIGUE STRENGTH OF PRESSURE VESSELS. 1: CYCLIC PRESSURE TESTS OF LARGE SIZE PRESSURE VESSELS. 2: LOW CYCLE FATIGUE TESTING OF ONE-HALF SCALE MODEL PRESSURE VESSELS. 3: EFFECT OF WELD DEFECTS ON THE FATIGUE STRENGTH OF A302B STEEL Progress Report

A. G. Pickett and S. C. Grigory 14 Sep. 1966 76 p refs

(Contract AT(11-1)-1228)

(SWRI-1228-1-28; SWRI-1228-2-28; SWRI-1228-5-28; PR-19) CFSTI: HC $3.00/MF $0.65

Studies to develop information required to analyze or predict pressure vessel strength and service life are described. Variables investigated were the properties of materials, design details, fabrication methods, and inspection techniques. NSA

N67-21076 Kernforschungsanlage, Juelich (West Germany). Institut fuer Reaktorwerkstoffe.

STATIC DISLOCATION THEORY FOR BODIES WITH FREE SURFACE [STATISCHE VERSETZUNGSTHEORIE FUER KOERPER MIT FREIER OBERFLAECHE]

Horst-Dietrich Dietze and Guenther Leibfried Dec. 1963 126 p refs In GERMAN

(JUL-142-RW) CFSTI: $3.00

Calculated are the inner stresses in crystals which are caused by static edge and screw dislocations, with emphasis on the effect of free surfaces on the field of stress and the dislocation energy. Dislocation in the infinitely extended material is initially considered, and solutions thus obtained are projected on the free surface in order to solve finite space problems. Calculations are based on two dislocation models: the first model assumes complete elasticity; the second model considers the atoms in the glide plane and treats the remainder of the crystal as being elastic. Covered in detail are the mathematical bases of the elasticity theory and the dislocation theory. Transl. by K.W.

N67-21178*# Northrop Corp., Newbury Park, Calif. Ventura Div.

THE DESIGN AND DEVELOPMENT OF RADIO FREQUENCY TRANSPARENT, OMNIDIRECTIONAL, ENERGY-ABSORBING ELEMENT SYSTEMS Final Report

Ronald H. Smith Washington, NASA, Jan. 1967 152 p refs

(Contract NAS1-5329)

(NASA-CR-66301; NVR-5014) CFSTI: HC $3.00/MF $0.65 CSCL 22B

The development, design, and fabrication of three types of rf transparent honeycomb, composite, and frangible tube element omnidirectional landing systems are discussed as well as the design and fabrication of a spherical test vehicle which was to be protected by these landing systems. The

filament wound tubes proved too inefficient and 2- and 3-in. diameter glass fabric reinforced plastic tube tests were substituted. A franging force of 22,300 lb. for an efficiency of 16,800 ft-lb/lb was obtained with the 3-in. tubes. It was necessary to conduct limited nylon phenolic honeycomb and frangible tube anisotropy tests to provide design data. Lightweight 1.0-in. tube franging dies were also developed with a weight one sixth that of steel dies. A sandwich shell spherical test vehicle with fiberglas skins and honeycomb/syntactic foam core was designed and fabricated, but the landing systems for each element type were not designed because spherical test segments developed instability after 2 in. of stroke and would have required more segment development effort. Author

N67-21330# Battelle Memorial Inst., Columbus, Ohio. Ohio State Univ., Columbus.
RESIDUAL STRAINS AND DISPLACEMENTS WITHIN THE PLASTIC ZONE AHEAD OF A CRACK
J. Cammett, A. R. Rosenfield, and G. T. Hahn Washington, NAS-NRC, Nov. 1966 26 p refs Prepared jointly with Ohio State Univ.
(Contract Nobs-92383)
(SSC-179; AD-644815) CFSTI: HC $3.00/MF $0.65

Strains and displacements in the plastically yielded region generated ahead of a machined notch and a crack were detected with an interferometric technique. The measurements were performed on Fe-3Si steel sheets after unloading and reflect local yielding under plane stress conditions. The results show that notch acuity within the limits examined has little effect on the strain distribution. Measured displacements are qualitatively in accord with the theoretical expectations of the DM (Dugdale-Muskhelishvili) model. Quantitative agreement is not obtained and this is attributed to work hardening and the Bauschinger effect, complications that are neglected in the calculation. The work also draws attention to a parameter—the width of the plastic zone at half maximum strain—useful for connecting displacement with maximum strain. Author (TAB)

N67-21366# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
SECOND ALL UNION SYMPOSIUM ON THE PROPAGATION OF ELASTIC-PLASTIC WAVES IN SOLID MEDIA
I. A. Tsurnal, Ya. F. Kayuk, and V. N. Buyvol 7 Oct. 1966 6 p refs Transl. into ENGLISH from Prikl. Mekh., Akad. Nauk Ukr. RSR (Kiev), v. 1, no. 3, 1965 p 140–141 Symp. held in Baku, 7–14 Oct. 1964
(FTD-HT-66-497; TT-67-60285; AD-644023) CFSTI: HC $3.00/MF $0.65

Conference papers on elastic, plastic, elastoplastic, stress, and shock waves are briefly mentioned. Wave formation and propagation in a variety of solids, the resulting stresses and deformations, and methods of determining these qualities were covered. Emphasis during the symposium was placed on the theory of wave dynamics. N.E.N.

N67-21374# Marine Engineering Lab., Annapolis, Md.
MEASUREMENT OF THE TOTAL STRUCTURAL MOBILITY MATRIX
James E. Smith Dec. 1966 80 p refs
(MEL-360/66; AD-644236) CFSTI: HC $3.00/MF $0.65

The results of an attempt to measure the total mobility matrix describing a point on a structure, including all translational and rotational effects, are presented. The results showed that the technique employed was extremely sensitive to small errors in the experimental data and that either greatly increased precision must be obtained in the experimental data or that the problem must be reformulated to avoid the effects of error propagation. An analysis of error propagation provided better understanding of the problem and suggested how it should be reformulated. The work that is continuing along this new avenue using modified experimental procedures is described. Author (TAB)

N67-21441* Texas Univ., Austin. Dept. of Civil Engineering.
FINITE ELEMENT METHOD APPLIED TO PROBLEMS IN STRESSES AND DEFORMATION OF SOIL
C. V. G. Vallabhan and Lymon C. Reese Jan. 1967 178 p refs
(Contract NsG-604)
(NASA-CR-66318) CFSTI: $3.00

The finite element method was applied to problems in plane strain and axially symmetric cases. The analysis is done by discretizing the continuum into rectangular and wedge-shaped elements interconnected at nodal points, and a stiffness matrix equation is developed relating the forces and the deflections at nodal points. The stiffness matrix equation is solved for a given set of body forces and boundary conditions. From the deflection of the nodal points, the state of stress and the state of strain at the center of each element are computed. Computer programs were written to solve plane strain and axially symmetric problems. Some nonlinear problems in plane strain and axially symmetric cases were solved and compared with experimental results. Remarkable agreement was observed between the computer solution and the experimental results. Author

N67-21571# Thermo Electron Enginering Corp., Waltham, Mass.
RESEARCH AND DEVELOPMENT OF VACUUM FOIL-TYPE INSULATION FOR RADIOISOTOPE POWER SYSTEMS
Quarterly Progress Report, Aug.–Oct. 1966
J. B. Dunlay, M. L. Paquin, V. L. Poirier, and L. van Someren 30 Nov. 1966 45 p
(Contract AT(30-1)-3634)
(NYO-3634-3; AL-3634-3) CFSTI: HC $3.00/MF $0.65

Progress is reported on the development of high temperature thermal insulation covering the period August through October 1966. The results of planar heat transfer tests are presented for Ta–ThO_2 insulation samples. Temperature profiles and effective heat transfer coefficients are established from the experimental heat transfer data. Results of the compatibility screening tests are summarized for exposures up to 2000 hours at 1700°C and 1900°C. Final designs are presented for a support insulation heat loss test assembly and an extended soak test assembly. Author (NSA)

N67-21688# Materials Research Lab., Inc., Richton Park, Ill.
DEVELOPMENT OF TEST PROCEDURES. FRACTURE TOUGHNESS OF REACTOR PRESSURE VESSEL STEELS
Progress Report, Aug. 1–Oct. 31, 1966
E. J. Ripling and P. B. Crosley 30 Nov. 1966 14 p
(Contract AT(11-1)-1477)
(COO-1477-6) CFSTI: HC $3.00/MF $0.65

Plane-strain, room-temperature, toughness values of A302-B, which appear to be valid, have been measured on reasonable sized specimens. The toughness decreased, and approached the value for crack arrest toughness, as the loading rate was increased. Author (NSA)

N67-21737# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
EXPERIMENTAL CHECK OF THEORETICAL METHODS OF THE CALCULATION OF STRENGTH
L. A. Kolesnikov 21 Nov. 1966 24 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. (USSR), no. 3, 1962 p 87–97
(FTD-MT-66-25; TT-67-60204; AD-643642) CFSTI: HC $3.00/MF $0.65

The simple summation of information extracted as a result of the processing of experimental data for transducers of elongations (displacements) processed separately from each other makes it possible to establish the linearity (nonlinearity) of the tense deformed state of the system (the zone and elements not controlled by measurements are excluded), to reveal the places of intensive increase of elongations, and to establish the approach of fluidity for elements found in a uniaxial stressed state. But with a sufficiently large quantity of transducers rationally fixed, the group processing permits deriving more complete information considerably exceeding the sum of information of the isolated transducers. In this work the method applied earlier to the treatment of isolated transducers is widespread in groups selected accordingly. Such an allowance permitted constructing a uniform method in conducting a confidence evaluation of theoretical methods of calculation according to experimental investigation. The control is conducted not only for the theoretical calculation as a whole, but also for the separate elements. Hypotheses and separate parameters are estimated, and a forecast of the behavior of the system is constructed, etc. Group processing of an experiment permits considerably expanding the volume and quality of information on conducting a system under a load and the obtaining of confidence estimates for theoretical methods of calculation. Author (TAB)

N67-21754# Short Bros. and Harland, Ltd., Belfast (Northern Ireland).
TEST PROGRAMME ON ALUMINUM HONEYCOMB SANDWICH COMPRESSION PANELS Summary Report
Nov. 1966 58 p refs
(Contract MOA-5/Exptl./4421/C.B.43(a)(2))
(S&T-MEMO-10/66) CFSTI: HC$3.00/MF$0.65

Forty-two panels were tested to confirm buckling stresses predicted by theory. Good general agreement was obtained between actual and estimated buckling stresses but there was some scatter in results for panels in the plastic range. The effect of the ratio of skin thickness on the value of the shear modulus of honeycomb cores as found by the shear beam technique was also investigated, and an expression for effective shear area giving reasonably constant values of shear modulus over a wide range of skin and core thickness was obtained. Double block shear specimens were found to be less reliable than shear beams in determination of shear modulus. Author

N67-21851# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
CONCENTRATION OF STRESSES AROUND A ROUGH BOUNDARY OF AN ELASTIC BODY
V. A. Pal'mov 24 Aug. 1963 12 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Otd. Tekhn. Nauk: Mekhan. i Mashinostr. (Moscow), no. 3, 1966 p 104–108
(FTD-TT-66-66; TT-67-60502; AD-645832) CFSTI: HC $3.00/MF $0.65

The work is devoted to the study of the concentration of stresses, near the rough boundary of an elastic body, at a plane stressed state. The results can be used also for plane deformation, when the boundary of an elastic body appears to be a cylindrical surface with incidental guidance. Author (TAB)

N67-21876# Naval Applied Science Lab., Brooklyn, N. Y.
FATIGUE OF LARGE SCALE UNIFORMLY LOADED SIMPLY SUPPORTED TEE-FILLET WELDED RECTANGULAR RIB-STIFFENED PLATES
M. Rosen and H. V. Cordiano Dec. 1966 35 p
(NASL-TM-6; NASL-9300-23; AD-645487) CFSTI: HC $3.00/MF $0.65

Fatigue and crack growth data were obtained on five tee-fillet welded rib-stiffened plate type specimens 56 by 28 by 1-1/2 in. fabricated from HY-80 steel. The specimens were cyclically loaded in the NASL plate type fatigue machine which permits application of a uniform pressure to a plate that is simply supported at four edges. Data were obtained on the initiation and growth of fatigue cracks, fatigue life, effect of weld notch acuity, and effect of cyclical loading at lower nominal stresses after a fatigue crack of 20 percent of the depth of the specimen was formed. Author (TAB)

33 THERMODYNAMICS AND COMBUSTION

Includes ablation, cooling, heating, heat transfer, thermal balance, and other thermal effects; and combustion theory. For related information see also: 12 Fluid Mechanics; and 27 Propellants.

N67-20393# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
TEMPERATURE FIELD OF ELEMENTS OF THIN-WALLED SATELLITE SURFACES IN RADIANT HEAT TRANSFER
V. M. Zaletayev *In its* Cosmic Res. 23 Jun. 1966 p 189–204 refs (See N67-20381 10-30) CFSTI: HC$3.00/MF$0.65

The problem of determining the temperature field of a thin walled surface acted upon by a certain stationary heat flow is solved for the case in which the heat is redistributed between zones of the surface by radiant heat transfer, and the solution obtained is analyzed for spherical and cylindrical surfaces. It is assumed that the curvature of the surface is of constant sign. Temperature fields of the type considered arise at the surfaces of Echo satellites, and on the surfaces of thin walled cylindrical unpressurized compartments of spacecraft. Author

N67-20445# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
JOURNAL OF ENGINEERING PHYSICS Selected Articles
8 Aug. 1966 28 p refs Transl. into ENGLISH from Inzh.-Fiz. Zh. (Minsk), v. 7, no. 4, Apr. 1964 p 8–17, 111–113
(FTD-MT-65-558; TT-67-60288) CFSTI: HC$3.00/MF$0.65

CONTENTS:

1. INVESTIGATION OF INFLUENCE OF INLET CONDITIONS ON HEAT EXCHANGE IN THE INITIAL LENGTH OF A PIPE P. N. Romanenko and N. V. Krylova p 1–18 refs (See N67-20448 10-33)

2. TURBULENT BURNING OF METHANE–OXYGEN MIXTURES F. B. Moin and V. U. Shevchuk p 19–23 refs (See N67-20447 10-33)

N67-20448# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
INVESTIGATION OF INFLUENCE OF INLET CONDITIONS ON HEAT EXCHANGE IN THE INITIAL LENGTH OF A PIPE
P. N. Romanenko and N. V. Krylova *In its* J. of Eng. Phys. 8 Aug. 1966 p 1–18 refs (See N67-20445 10-33) CFSTI: HC $3.00/MF$0.65

The effects of smooth entry, confusor inlets with contraction angles of 30°, 45°, and 60°, sudden contraction and expansion of the flow and the hydrodynamic stabilization portion on heat transfer in the starting length of the tube are experimentally studied. The laws of heat transfer in a starting length of the tube at various inlet conditions are obtained. Correlation of the data by means of

the local modeling theory permits the extension of these laws to any inlet conditions except the region near the entry section with sudden flow expansion. Calculation formulas are presented for determining the thermal stabilization length with prescribed laws of change of the wall temperature and heat flux along the tube length. Author

N67-20447# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
TURBULENT BURNING OF METHANE-OXYGEN MIXTURES
F. B. Moin and V. U. Shevchuk *In its* J. of Eng. Phys. 8 Aug. 1966 p 19–23 refs (See N67-20445 10-33) CFSTI: HC $3.00/MF $0.65

Turbulent burning rates of methane–oxygen mixtures of different composition are determined by the method of a flat turbulent flame burner depending on turbulence intensity and the diameter of the burner. The turbulent rate of a flame does not depend on turbulence scale when the diameter changes from 6.4 to 11.7 mm. Functional dependence u_T on laminar rate of a flame and turbulence is obtained. Author

N67-20457 Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
JOURNAL OF ENGINEERING PHYSICS Selected Articles
29 Jul. 1966 19 p refs Transl. into ENGLISH from Inz.-Fiz. Zh. (Moscow), v. 7, no. 2, 1964 p 117–119, 120–124
(FTD-HT-66-307; TT-67-60283; AD-644013) CFSTI: HC $3.00/MF $0.65

CONTENTS:

1. THE QUESTION OF HEAT AND MASS EXCHANGE DURING EVAPORATION OF WATER FROM A POROUS WALL V. P. Isachenko and V. V. Vzorov p 1–5 refs (See N67-20458 10-33)
2. THE METHODOLOGY OF INVESTIGATING EVAPORATION COOLING WITH POROUS METALLIC BODIES A. V. Lykov and Z. P. Shul'man p 6–14 refs (See N67-20459 10-33)

N67-20458 Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE QUESTION OF HEAT AND MASS EXCHANGE DURING EVAPORATION OF WATER FROM A POROUS WALL
V. P. Isachenko and V. V. Vzorov *In its* J. of Eng. Phys. 29 Jul. 1966 p 1–5 refs (See N67-20457 10-33) CFSTI: HC $3.00

A rebuttal to a critical view of a previously published article is presented. It is pointed out that an intensification of surface evaporation inside the plate is determined not by the equalization of the heat balance in the evaporation zone, but by the equalization of mass balance. It is also stated that during comparatively small transverse mass flows, there is an intensification of heat exchange, but a subsequent increase of the transverse flow leads to a decrease in heat transfer. N.E.N.

N67-20459# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE METHODOLOGY OF INVESTIGATING EVAPORATION COOLING WITH POROUS METALLIC BODIES
A. V. Lykov and Z. P. Shul'man *In its* J. of Eng. Phys. 29 Jul. 1966 p 6–14 refs (See N67-20457 10-33) CFSTI: HC $3.00

A previously published article is critically reviewed, and errors are identified. It is pointed out that the heat transfer coefficient was incorrectly calculated, and that the experimental methodology unsuccessfully determined the heat and mass transfer. Details on these aspects are given. N.E.N.

N67-20537# Avco Corp., Wilmington, Mass.
THERMODYNAMICS OF CERTAIN REFRACTORY COMPOUNDS. VOLUME I: DISCUSSION OF THEORETICAL STUDIES, SECTIONS I–VI
Harold L. Schick ed. 1966 681 p refs
(Contract AF 33(657)-8223)
(AD-652550) CFSTI: HC $3.00/MF $0.65

The work includes a study of the thermodynamics of the Borides, carbides, nitrides, and oxides of 31 elements in the temperature range from 0 to 6000K. The elements are (a) group 11A-beryllium, magnesium, calcium, and strontium; (b) group 111B-scandium, yttrium, and lanthanum, (c) group iva-silicon; (d) group ivb-titanium, Zirconium, and hafnium, (e) group vb-banadium, niobium, and tantalum; (f) group vib-chronium, molybdenum, and tungsten; (g) group viib-manganese, technetium, and rhenium; (h) group viii-rhodium, osmium, iridium, and platinum; (i) rare earths-cerium, neodymium, samarium, gadolinium, and dysprosium; and (j) actinides-uranium and thorium. More than 160 thermodynamic tables, together with comprehensive discussions, were prepared. Volume I, presents a summary of the techniques used to analyze thermodynamic data and gives the data analyses for refractories considered. Author (TAB)

N67-20553# Louvain Univ. (Belgium). Lab. of Inorganic Chemistry.
EXPERIMENTAL STUDY OF THE DEFLAGRATION OF GASES AND SOLIDS Final Scientific Report
A. Van Tiggelen Oct. 1966 48 p refs
(Grant AF-EOAR-65-67)
(AFOSR-66-2763; AD-643439) CFSTI: HC $3.00/MF $0.65

First a general survey is given of the research undertaken under this grant. Three topics have progressed during the last year in a sufficient manner as to be reported in this document. (I) Burning velocity, flame temperature and reaction zone thickness are reported for gaseous mixtures of hydrogen cyanide, oxygen and nitrogen at different richnesses and dilutions. Accepting the model of an homogeneous reaction for the flame reaction zone, global activation energies and reaction orders are derived. (II) The application of a new technique (simulating burner) allows the estimation of the amount of heat transferred from the flame reaction zone upstream to the burning surface of a solid propellant. Some preliminary data are presented for given conditions of flow and zeroeth degree of mixedness in the preparation zone upstream of the flame. (III) The comparative intensities of CH or C2 show that the yield of excited C2 or CH radicals per molecule of fuel oxidized in the flame is about 1.4 times larger in isobutane than in normal butane flames (with oxygen) at the same richness and degree of dilution with nitrogen. Author (TAB)

N67-20578# Bureau of Mines, Pittsburgh, Pa.
HOT GAS IGNITION TEMPERATURES OF HYDROCARBON FUEL VAPOR-AIR MIXTURE
J. M. Kuchta and R. J. Cato [1966] 18 p refs
(BM-RI-6857; AD-643518) CFSTI: HC $3.00/MF $0.65

Laminar hot air jets of 1/8- to 3/4-inch diameter were used to determine the hot gas ignition temperatures of various combustible vapor-air mixtures. The combustibles were n-hexane, n-octane, n-decane, a hydrocarbon jet fuel (JP-6), and an adipate ester aircraft engine oil (MIL-L-7808). Minimum ignition temperatures occurred at a fuel to air weight ratio of about 0.5 and were not greatly sensitive to variations of fuel concentration. Moderate variations of jet velocity also had little influence on these ignition temperatures. However, these temperatures decreased with increase in heat source dimensions (jet diameter). The hot gas ignition temperatures of the combustibles were not necessarily much greater than corresponding autoignition and wire ignition temperatures when the size of the heat source and the ignition criterion were the same. Author (TAB)

N67-20595# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

THERMOELECTRIC COOLING

Z. Poslt 12 Apr. 1966 24 p refs Transl. into ENGLISH from Sdelovaci Tech. (Czechoslovakia), v. 12, no. 7, 1964 p 248–252 (FTD-TT-65-1762; TT-66-62516; AD-641105) CFSTI: HC $3.00/MF $0.65

A review is given of the advantages and physical principles of thermoelectric cooling. Particular attention is given to the design and performance characteristics of thermoelements developed by the A.S. Popov VUST. TAB

N67-20614# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

HEAT OPTIMUM ACCELERATION IN CENTRAL FIELD

G. B. Yefimov and D. Ye. Okhotsimskiy 31 Aug. 1966 30 p refs Transl. into ENGLISH of the publ. "OB Optimal'nom Razgone v Tsentral'nom Pole" USSR, 1965 p 1–28 (FTD-MT-65-588; AD-643951) CFSTI: HC $3.00/MF $0.65

Consideration is given to a variational problem about optimum acceleration of spacecraft with low thrust, starting from an orbit close to circular and attaining hyperbolic velocity. Regularities of optimum motion were investigated. A comparison was made with motion under action of constant tangential acceleration. considerations are given pertaining to construction of a limiting solution of variational problem, calculation of which would allow one to reduce estimation of basic parameters of optimum acceleration to the use of a table with one entry or to calculation by means of the final formulas. Author (TAB)

N67-20623# Air Force Systems Command, Wright-Patterson AFB, Ohio. Aero Propulsion Lab.

A PROPOSED CORRELATION SCHEME FOR GAS-FLIM COOLING DATA Technical Report, Oct. 1965–Apr. 1966

G. W. Haering Aug. 1966 32 p refs (AFAPL-TR-66-56; AD-643523) CFSTI: HC $3.00/MF $0.65

The cooling of air-breathing engines and rocket motors by gas film was studied by many investigators. Even at subsonic speeds, the correlations and empirical formulae of various investigators do not produce data that are in agreement. A correlating scheme is proposed which, although not perfect, does take into consideration the experimental data from several sources and the variables that make any such scheme extremely difficult. The report includes a brief history of gas-film cooling and a discussion of some of the major factors affecting gas-film cooling -- such factors as pressure gradients, injection geometry velocity mismatch of the coolant stream, and temperature ratio. Although a scheme is proposed, the inherent problems warrant further investigations. Author (TAB)

N67-20691# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

DETERMINATION OF IGNITION CONDITIONS

A. M. Girshin and O. M. Todes 29 Aug. 1966 17 p refs Transl. into ENGLISH from Zh. Prik. Mekhan. i Techn. Fiz. (Moscow), no. 1, 1965 p 68–75 (FTD-HT-66-456; TT-67-60250; AD-643952) CFSTI: HC $3.00/MF $0.65

A simple method for determining ignition conditions based on linearization of initial nonlinear equations is presented. Good agreement between precise ignition conditions and approximations obtained by means of the linearization method is demonstrated by examples. A physical interpretation of the linearization method is given. Author (TAB)

N67-20692# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

USE OF FINITE DIFFERENCE METHOD TO SOLVE THE PROBLEM OF HEAT TRANSFER BETWEEN A GAS AND TURBINE BLADE

A. M. Topunov and Yu. N. Kulesh 2 Sep. 1966 18 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Aviats. Tekh. (Kazan), no. 3, 1965 p 119–126 (FTD-HT-66-487; TT-67-60292; AD-644052) CFSTI: HC $3.00/MF $0.65

Four systems of finite difference equations of varying complexity are used for determining the measurement of the temperature of the uncooled blades along the apex. Computations are accomplished indicating the magnitude of the summary error with varying quantities of sections and utilizing various systems of finite difference equations. The possibility of applying investigated assumptions in the construction of finite difference equations for the determination of temperatures of turbine blades, along the apex undergoing cooling, is shown. An example is given of the computation of the temperature of a blade undergoing air cooling. Author (TAB)

N67-20701# Los Alamos Scientific Lab., N. Mex.

RAPID QUENCHING DROP SMASHER

D. R. Harbur, J. W. Anderson, and W. J. Maraman 18 Nov. 1966 24 p refs (Contract W-7405-ENG-36) (LA-3584) CFSTI: HC $3.00/MF $0.65

A device for rapidly quenching liquid metals into thin platelets is described. This rapid quenching equipment is built around the technique of catching a molten drop of metal between a rapidly closing plate and a stationary plate. The closing speed of the smasher plate at impact is 12.6 ft/sec. The quenching rate for this device is controlled by the interface resistance between the plates and the platelet, and is dependent upon the heat content and density of the material being quenched. The initial quenching rate down to the freezing point of the platelet material is 10^5 to 10^6°C/sec. After an isothermal delay, which is proportional to the heat of fusion of the platelet material, the final cooling rate down to the temperature of the smasher plates is 10^4 to 10^5°C/sec. Author

N67-20780# Commissariat a l'Energie Atomique, Grenoble (France). Service des Transferts Thermiques.

THE OSCILLATORY BEHAVIOR OF HEATED CHANNELS. AN ANALYSIS OF THE DENSITY EFFECT. PART I:

Jean Boure Sep. 1966 40 p refs Sponsored in part by joint USAEC EURATOM Res. and Develop. Program (CEA-R-3049)

The problem of the oscillatory behavior of heated channels is presented in terms of delay–times and a density effect model is proposed to explain the behavior. The density effect is the consequence of the physical relationship between enthalpy and density of the fluid. Non-linear equations are derived from the model in a dimensionless form. A description of the mechanism of oscillations is given, based on the analysis of the equations. An inventory of the governing parameters is established. At this point of the study, some facts in agreement with the experiments can be pointed out. Autho (NSA)

N67-20770# Comitato Nazionale per l'Energia Nucleare, Rome (Italy).

BOILING HEAT TRANSFER. REPORT OF ADVANCES UP TO SEPTEMBER 30, 1965 [EBOLLIZIONE IN CONVEZIONE LIBERA.

M. Como, G. Farello, and G. C. Pinchera 1966 79 p refs In ITALIAN
(Contract EURATOM-24-64-4 TEAL)
(RT/ING/66-3)

A pool boiling experiment is described, concerning boiling mechanism and critical heat flux with water and carbon tetrachloride. Effect of heater characterisitcs, such as diameter and orientation, on critical heat flux of both organics and water have been investigated. Bubble parameters (diameter vs time, maximum diameter, frequency, waiting ang growth times) have been measured, as a function of heat flux and subcooling, by boiling water in horizontal tubes of stainless steel. Author (NSA)

N67-20840# Commissariat a l'Energie Atomique, Grenoble (France). Centre d'Etudes Nucleaires.
THE OSCILLATORY BEHAVIOR OF HEATED CHANNELS: AN ANALYSIS OF THE DENSITY EFFECT. PART II: THE OSCILLATIONS THRESHOLDS (LINEARIZED ANALYSIS)
Jean Boure Sep. 1966 39 p refs
(CEA-R-3049, Pt. 2)

The start of the oscillatory behavior of heated channels is studied in terms of the density effect, a consequence of the physical relationship between enthalpy and density of the fluid. The threshold equations are derived, after linearization of the equations obtained in Part I. They can be solved rigorously by numerical methods to yield: (1) a relation between the describing parameters at the onset of oscillations, and (2) the frequency of the oscillations. By comparing the results predicted by the model to the experimental behavior of actual systems, the density effect is very often shown to be the actual cause of oscillatory behaviors. Author (NSA)

N67-20842# New Mexico Univ., Albuquerque. Dept. of Mechanical Engineering.
TRANSIENT STRAIN AND TEMPERATURE DISTRIBUTIONS IN LONG CIRCULAR CYLINDERS COOLED BY EMISSION OF THERMAL RADIATION
M. W. Wildin and R. S. Pritchard [1966] 25 p refs Presented at the Ann. Meeting and Exposition of the Soc. for Exptl. Stress Analysis, Pittsburgh Prepared for Sandia Corp., Albuquerque, N. Mex.21366
(Contract AT(29-1)-789)
(SC-DC-66-1517; CONF-661105-1) CFSTI: HC $3.00/MF $0.65

Techniques used to experimentally and analytically determine temperature and strain distributions produced by radiative cooling of long circular cylinders are described. Analytical results were obtained by finite difference techniques. The low level dynamic thermal strains, measured by means of embedded strain gages, agreed with the predicted values within acceptable limits. Results are presented for the highest strain level and the highest temperature for which the properties of the model were known. Author (NSA)

N67-20859# Sandia Corp., Albuquerque, N. Mex.
THE EXPLOSION-FREE COMBUSTION OF ZIRCONIUM DROPLETS
L. S. Nelson 1966 16 p refs Presented at the Combustion Inst., Western States Sect. Spring Meeting, Denver, 25-26 Apr. 1966
(Contract AT(29-1)-789)
(SC-DC-66-1127; CONF-660447-1) CFSTI: HC $3.00/MF $0.65

When submillimeter zirconium droplets burn under ordinary conditions, the individual combustions almost always appear to terminate in violent fragmentations. By using either relatively large droplets or highly purified metal and oxidizers, it was found that the explosions can be eliminated, allowing study of oxidative phenomena that are obscured by the explosions. Gravimetric studies showed that as much as 45% of the total oxidation may be masked by the fragmentations. Once the explosions were eliminated, it became possible to study the following: room temperature colors of droplets quenched in the final stages of combustion; spearpointing; and rates of oxidation. NSA

N67-20877# General Electric Co., San Jose, Calif. Atomic Power Equipment Dept.
TRANSITION BOILING HEAT TRANSFER PROGRAM Quarterly Progress Report, Apr.-Jun. 1966
E. P. Quinn 1 Jul. 1966 22 p refs
(Contract AT(04-3)-189)
(GEAP-5191; EURAEC-1704; QPR-14) CFSTI: HC $3.00/MF $0.65

Film boiling coefficients were measured in order to resolve differences found in previous annular test data. Increasing the distance between spacers was found to reduce the fully-developed film boiling coefficient. The droplet slip velocity for mist flow and the contribution of convection to droplet heat transfer were evaluated. Author (NSA

N67-20878# California Univ., Berkeley. Office of Research Services.
TRANSIENT BOILING PHENOMENA. VOLUME II: EXPERIMENTAL RESULTS
V. E. Schrock, H. A. Johnson, A. Gopalakrishnan, K. E. Lavezzo, and S. M. Cho May 1966 130 p refs
(Contract AT(11-1)-34)
(SAN-1013, Vol. 2; NE-66-2) CFSTI: HC $3.00/MF $0.65

Exponential transient data collected on transient pool boiling and transient boiling in channel tests are summarized. The four basic test parameters investigated were pressure, subcooling, exponential period, and velocity. NSA

N67-20885# California Univ., Berkeley. Lawrence Radiation Lab.
THE HEAT CAPACITY OF SOLID ^{4}He AT MOLAR VOLUMES BETWEEN 20.5 AND 21.1 cm^3/MOLE
William Reavis Gardner (Ph.D. Thesis) Aug. 1966 84 p refs
(Contract W-7405-ENG-48)
(UCRL-16450) CFSTI: HC $3.00/MF $0.65

The heat capacity of ^{4}He was measured under constant volume conditions from 0.32°K to the melting curve and at fourteen volumes ranging from 20.50 to 20.934 cm^3/mole. The measurements offer a significant increase in precision over other recently reported data and thus provide more definite answers to several outstanding questions. A linear term of 1.25 T millijoules/mole-°K was found in the heat capacity of the hcp phase, independent of volume and thermal history to within the precision of the measurements. Otherwise the hcp solid was found to be well-behaved and to have a Grüneisen constant of 3.2 ± 0.1 in this region. The thermal expansion coefficient was found to be definitely positive throughout the hcp phase and 90% of the bcc phase, although the possibility of a negative coefficient near the low-temperature limit of the latter phase cannot be ruled out conclusively. The heat capacity of the bcc solid depends very strongly on density, exhibiting values of 8 to more than 30 for the Grüneisen γ. For this solid no discontinuity in C_v is observed at the melting temperature, but the onset of melting is preceded by a narrow region of steeply increasing heat capacity which appears to be due to vacancy formation. Author (NSA)

N67-20917# Kernforschungsanlage, Juelich (West Germany). Institut fuer Reaktorbauelemente.
THERMODYNAMIC VALUES FOR AIR, CARBON DIOXIDE, AND NITROGEN AT HIGH TEMPERATURES AND PRESSURES [THERMODYNAMISCHE STOFFWERTE VON LUNT, KOHLENDIOXYD UND STICKSTOFF BEI HOHEN TEMPERATUREN UND DRUECKEN]

K. Hammeke et al Jul. 1966 52 p refs
(JUL-383-RB) CFSTI: HC$3.00/MF$0.65

In the evaluation and dimensionless representation of heat transfer and pressure loss measurement, values at higher pressures and temperatures were necessary. The density, specific heat, dynamic multiplicity, and the heat conductivity of air, carbon dioxide, and N were inferred for temperatures up to 1,300°K and for pressures up to 80 atm. Sufficiently accurate formulas were developed for use in electronic data processing installations and tables were prepared. At high temperatures and pressures very few experimental data are available. The uncertainties are very large for the parameters c_p, μ, and λ. Only a relatively small pressure effect, which lies within the measurement accuracy, was found from the measurements. Author (NSA)

N67-20939# General Electric Co., Schenectady, N. Y. Knolls Atomic Power Lab.
LION: TEMPERATURE DISTRIBUTIONS FOR ARBITRARY SHAPES AND COMPLICATED BOUNDARY CONDITIONS
J. R. Schmid, G. L. Lechliter, and W. W. Fischer 27 Jul. 1966 78 p refs handle
(Contract W-31-109-ENG-52)
(KAPL-M-6532) CFSTI: HC$3.00/MF$0.65

LION is a digital computer program which will solve three-dimensional transient and steady-state temperature distribution problems. The input consists of geometry, physical properties, boundary conditions, internal heat generation rates, and coolant flow rates as a function of time. In addition to solving problems of heat conduction in a structure, LION can handle forced convection, free convection, and radiation or a combination of these at the surface of the structure. The output consists of complete nodal temperature distributions along with surface fluxes and surface heat transfer coefficients. An option is included in the program for determining the mean temperature in any specified section of the structure. The first forward difference method is used in obtaining the solution. The approximate running time on the CDC 6600 is steady-state–1 min/10 nodes, and transient–1.5 min/10 nodes. Author (NSA)

N67-21004# General Electric Co., Schenectady, N. Y. Research and Development Center.
A PROGRAM OF TWO-PHASE FLOW INVESTIGATION Quarterly Report, Apr.–Jun. 1966
P. G. Kroeger and N. Zuber 1 Jul. 1966 78 p refs
(Contract AT(04-3)-189)
(GEAP-5203; EURAEC-1705; QR-13) CFSTI: HC$3.00/MF$0.65

The dynamic behavior and the stability of a two-phase mixture with heat addition are significantly affected by the void formation in the subcooled boiling regime. It was shown in previous work that prediction of the void fraction requires knowledge of four parameters: the distribution parameter C_0, the vapor drift velocity V_g, the point of incipient vapor formation z_0, and the axial temperature distribution function T^+. The effects of these parameters on the void fraction in subcooled boiling were analyzed and are presented. The distribution parameter C_0 is of major importance towards the end of the subcooled regime, where thermodynamic equilibrium is approached. The vapor drift velocity has only a minor effect in forced convection systems with high mass flow rates. The point of incipient vapor formation z_0 greatly affects the predicted void fraction in the subcooled regime. No reliable criterion for predicting the location of this point exists at this time. It was concluded, therefore, that further work to define and predict its location is mandatory for reliable and accurate prediction of void fractions in subcooled boiling. The axial temperature distribution has been approximated by different functions that satisfy the physical boundary conditions. It appears that the precise specification of the temperature distribution is of secondary importance when compared to the need of locating properly the point of initial vapor formation z_0. The profiles used give satisfactory results when compared to available experimental data. However, final conclusion must be reserved until a method for predicting z_0 becomes available. The results of the analysis show that changing the conditions of the heated surface and the introduction of additives may have two effects on the void fraction in subcooled boiling. These effects are discussed and a method for taking them into account is presented. Satisfactory agreement is shown between predicted void fractions and recent experimental data obtained in subcooled boiling of Refrigerant-22 and of water over a pressure range of $0.22 \leq p_r \leq 0.65$ and $0.005 \leq p_r 0.22$ respectively. Author (NSA)

N67-21076# Kernforschungsanlage, Juelich (West Germany). Institut fuer Reaktorentwicklung.
GENERAL STUDY OF TEMPERATURES, PERFORMANCE STRENGTH, AND HEAT TRANSFER (MOSEL) [MOSEL—ALLGEMEINE STUDIE UEBER TEMPERATUREN, LEISTUNGSDICHTE UND WAERMEUEBERGANG]
Uri Gat Aug. 1965 76 p refs in GERMAN
(JUL-296-RG) CFSTI: $3.00

A parametric feasibility study centering on capacity and temperature of the Molten–Salt Reactor /MSRE/ was performed. The study is based on an assumption of optimum output with certain limitations in structural dimensions and heat transfer. Plates as well as pipes were considered as fuel. The limitation for laminar fuel flow was found to depend on the maximum possible temperature difference between fuel center and wall ($\Delta\theta_f$) and the heat conductivity (λ). In case of turbulent fuel flow, output was limited by characteristics of the structural material only. The effect of the structural material on the core temperature was investigated. Volumetric ratios of fuel to structural material and to coolant are given as a function of structural dimensions. Molten salt and sodium were considered as coolants. A correlation formula for core dimensions, heat flux, and starting heat is presented. The interdependence of fuel, structural material, and coolant is mainly affected by heat flux, and the appropriate method for core calculations is given. Transl. by K.W.

N67-21160 Aeronautical Research Council (Gt. Brit.)
A METHOD FOR CORRECTING MEASUREMENTS OF THE HEAT TRANSFER FACTOR THROUGH THE SKIN OF A WIND TUNNEL MODEL
B. A. M. Piggott London, HMSO, 1966 19 p refs Supersedes RAE-TN-MATH-110; ARC-26537; see N67-20737
(ARC-CP-860; RAE-TN-MATH-110; ARC-26537) CFSTI: $3.00

In an experiment in which it is required to measure the heat transfer factor at the outer surface of the skin of a wind tunnel model, the temperature of the skin is measured at various points on this surface and the heat flow rate across the skin is measured at the corresponding points on the inner surface. Calculation of the heat flow rate across the outer surface of the skin involves the solution of Laplace's equation in a rectangular region with mixed boundary conditions. A numerical method of solution is described and illustrated by an example. Author

N67-21162* West Virginia Univ., Morgantown. Dept. of Mechanical Engineering.
DIGITAL COMPUTER ANALYSIS OF TEMPERATURE CONTROL CHARACTERISTICS OF SPACECRAFT LOUVERS IN SUNLIGHT
Jerome F. Parmer and David L. Buskirk [1967] 53 p refs
(Grant NGR-49-001-014)
(NASA-CR-83116) CFSTI: HC$3.00 CSCL 20M

A digital computer program has been developed which gives a complete description of all the pertinent heat transfer

characteristics of the louver system for all angles of louver openings and all angles of solar incidence for the case of specular, parallel, louver blades mounted over a diffusely reflecting "white" surface. Accumulative strata charts are used for certain special cases in order to aid the explanation of the complex functional relationship between solar position, louver poisition, and net heat transfer rate. This method of presentation vividly demonstrates the effect of the equilibrium temperature of the blades and the role each surface plays in the radiation network. Author

N67-21392*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

ANALYSIS OF TRANSIENT HEAT TRANSFER THROUGH A COLLISIONLESS GAS ENCLOSED BETWEEN PARALLEL PLATES

Morris Perlmutter Washington, NASA, 1967 18 p refs To be presented at the 9th Natl. Heat Transfer Conf., Seattle, 6–9 Aug. 1967 Sponsored by the Am. Inst. of Chem. Engr. and ASME.
(NASA-TM-X-52278) CFSTI: HC $3.00/MF $0.65 CSCL 20M

The problem of transient heat transfer through a monatomic collisionless ideal gas enclosed between parallel walls with wall accommodation coefficients of unity is analyzed for the case of a step change in one wall temperature. The results indicate that steady state heat transfer condition is approached in an oscillatory manner requiring about 20 to 30 crossings of the atoms across the channel at the mean thermal velocity based on the initial wall temperature, to achieve steady state. The solution is obtained in terms of an arbitrary quantity Q transported across a unit elemental area some distance X from the channel wall. Results for other transported quantities than energy i.e. density, temperature, can be obtained from the present formulation. The results can be readily extended to an arbitrary change in wall temperature as a function of time. Author

N67-21395*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

THERMAL RADIATION FROM A GAS NOT IN LOCAL THERMODYNAMIC EQUILIBRIUM

John R. Howell Washington, NASA, 1967 20 p refs To be Presented at the Am. Soc. of Mech. Engr. Natl. Heat Transfer Conf., Seattle, 6–10 Aug. 1967
(NASA-TM-X-52277) CFSTI: HC $3.00/MF $0.65 CSCL 20M

The validity of the assumption that local thermodynamic equilibrium is present in a gas is examined with respect to its effect on the calculated emission of thermal radiation. The spectral distribution of energy emitted by the gas is determined when there is departure from equilibrium. Attention is confined to the case of insufficient interparticle collisions being available to redistribute the energy of absorbed radiation. Thus the equilibrium distribution of energy states in the gas cannot be maintained. Emission of radiation from such a gas is not in the usual spectral energy distribution determined by the equilibrium spectral absorption coefficient and the Planck distribution. Specifically, the case of the grey gas is used to derive some approximate relations for characterizing the conditions where departure from equilibrium might be expected. Author

N67-21437# General Electric Co., Philadelphia, Pa. Missile and Space Div.

RESEARCH STUDY OF RADIATION HEAT FLUX FROM HIGH PRESSURE AIR ARCS

C. H. Marston, G. Frind, and V. Mishkovsky Arnold AF Sta., Tenn., Arnold Eng. Develop. Center, Dec. 1966 134 p refs
(Contract AF 40(600-1126)
(AEDC-TR-66-258; AD-644376) CFSTI: HC $3.00/MF $0.65

A method was developed for computation of radiant interchange within an electric arc where self absorption is important. Most or all radiation in the vacuum u.v. range is reabsorbed before it gets out of the arc. Present values of absorption coefficients are within an order of magnitude of predicting radiation losses as determined by direct experimental measurement. An arc was operated in air at 100 atmospheres sufficiently quiescent to measure a temperature profile at 100 amperes but great care must be taken to start symmetrically and avoid disturbances. At 400 amperes even extreme precautions are not sufficient to forestall instabilities. The air arc constrictor is uncooled and is designed for quasi-steady operation for 1 to 5 milliseconds depending on current level. Author (TAB)

N67-21451*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

HEAT CONDUCTION AS AN EQUIVALENT EIGENVALUE PROBLEM

John H. Lynch Washington, NASA, Mar. 1967 31 p refs
(NASA-TM-X-1362) CFSTI: HC $3.00/MF $0.65 CSCL 20M

The nonhomogeneous heat-conduction equation has been examined subsequent to its transformation into a discrete spectrum eigenvalue form. Theorems have been derived which relate the average source temperature to variations in the thermal conductivity and/or source over any part of the system. These theorems are applicable to purely conducting systems composed of simply or multiply connected sources and nonsources having mathemaical interface boundary conditions (continuity of temperature and heat flux). It is expected that these theorems will find practical application for conduction systems, much like the perturbation formulae of nuclear reactor physics. The theorems are general, however, and are not restricted in application to heat conduction systems. The application of these methods to any system behavior that can be described by the heat-conduction equation requires only a physical interpretation of the eigenvalue. Author

N67-21505# Argonne National Lab., Ill.

APPLICATION OF THE VARIATIONAL METHOD FOR SOLUTION OF HEAT CONDUCTION PROBLEMS WITH INTERNAL HEAT SOURCES [PRIMENENIE VARIATSIONNOGO METODA DLYA RESHENIYA ZADACH TEPLOPROVODNOSTI S VNUTRENNIMI ISTOCHNIKAMI TEPLA]

A. M. Fain Oct. 1966 11 p refs Transl. into ENGLISH from Inzh.-Fiz. Zh. (USSR), v. 10, no. 5, 1966 p 668–675
(ANL-TRANS-392) CFSTI: HC $3.00/MF $0.65

The variation method considered which reduces the solution of the two-dimensional heat conduction equation to a set of linear differential equations is very simple and shows good convergence. The method suggested for choosing the coordinate functions and the possibility of application of the simplest integrators for calculation of coefficients of Euler's equation set make this method convenient for practical use. Author (NSA)

N67-21515# Aerojet-General Nucleonics, San Ramon, Calif.

ALKALI METALS EVALUATION PROGRAM. THE SPECIFIC HEAT OF LIQUID CESIUM

P. Y. Achener and D. L. Fisher [1966] 28 p refs
(Contract AT(04-3)-368)
(AGN-8192, Vol. 5) CFSTI: HC $3.00/MF $0.65

The enthalpy and specific heat of liquid cesium at temperatures between 1200° and 1850°F are reported. The experimental method involved the use of a Bunsen ice calorimeter. The equation proposed for the enthalpy of liquid cesium from the melting point to 2000°F is: $H_T^\circ - H_{32^\circ F}^\circ = 7.60 + 0.0550$ Btu/lb where T is in degrees Fahrenheit. The resulting value for the specific heat liquid cesium is $C_p = 0.0550$ Btu/lb °F. Author (NSA)

N67-21516# Aerojet-General Nucleonics, San Ramon, Calif.
ALKALI METALS EVALUATION PROGRAM Quarterly Progress Report, 1 Jul.–30 Sep. 1966
P. Y. Achener 30 Sep. 1966 28 p refs
(Contract AT(04-3)-368)
(AGN-8202) CFSTI: HC $3.00/MF $0.65

Results are reported for studies on thermodynamic and transport properties of Cs, Rb, Li, and Na. Studies were made on Li and Na for heat pipe applications. The properties measured include PVT relations, vapor thermal conductivity, liquid viscosity, vapor viscosity, and specific heat for Cs and Rb and vapor pressure, surface tension and contact angle of the liquid and its vapor, liquid and vapor viscosity, and specific heat for Na and Li. Data are tabulated. NSA

N67-21597# Los Alamos Scientific Lab., N. Mex.
THERMAL DIFFUSIVITY OF PYROLYTIC GRAPHITE FROM 25 TO 1900°C
B. H. Morrison, K. J. Klein, and L. R. Cowder 1966 15 p refs Presented at the 6th Conf. on Thermal Conductivity, Dayton, Ohio
(Contract W-7405-ENG-36)
(LA-DC-8307; CONF-661032-2) CFSTI: HC $3.00/MF $0.65

The thermal diffusivity of pyrolytic graphite discs and hollow cylinders was measured from 25 to 1900°C by the flash technique. A ruby laser system was used as the pulsed energy source; a chromel-constantan-thermocouple and a photomultiplier tube detected the transient time-temperature response of a thin sample. Corrections for the heat loss and finite pulse time are included in the thermal diffusivity calculations. The data are compared with thermal measurements published by other laboratories. Problems inherent in thermal properties measured of a highly anisotropic material are discussed. Author (NSA)

N67-21626# General Electric Co., San Jose, Calif. Atomic Power Equipment Dept.
TRANSITION BOILING HEAT TRANSFER PROGRAM Quarterly Progress Report, Jul.–Sep. 1966
E. P. Quinn 1 Oct. 1966 18 p refs
(Contract AT(04-3)-189)
(GEAP-5278; EURAEC-1739; QPR-15) CFSTI: HC $3.00/MF $0.65

A new test section has been designed to obtain film boiling heat transfer measurements for flow inside a heated tube. Two types of probes for measurement of the steam phase superheat level will be used with the test section: a temperature probe utilizing separation of the moisture from the steam, and a Pitot tube from which the steam temperature can be inferred. Fabrication of the test assembly has been started. Author (NSA)

N67-21637# Argonne National Lab., Ill.
BOILING OF LIQUID ALKALI METALS [DAS SIEDEN VON FLUESSIGEN ALKALIMETALLEN]
G. Grass, H. Kottowski, and R. Warnsing Sep. 1966 37 p refs Transl. into ENGLISH from the German preprint, Aug. 1966 43 p
(ANL-TRANS-390) CFSTI: HC $3.00/MF $0.65

Boiling of liquid metals at low pressures is of an unstable nature under stagnant conditions as well as under conditions of natural and forced convection. This unstable type of boiling may be interpreted as an ejection sequence of single bubbles. The kinetics involved in this ejection process are significantly influenced by the vapor pressure in the bubble. The latter depends largely on the initial superheat of the liquid which amounted for the present experimental conditions to 85°C for circulating potassium and to 130°C for stagnant potassium. During the expansion the pressure in the vapor space rapidly sinks from a high initial value, apparently due to the fact that not sufficient vaporization occurs. Initial superheat, initial pressure, and subsequent pressure variations were for various experimental conditions compared with the kinetics of the single bubble ejections. A calculation model was set up to correlate quantitatively the phenomena. Author (NSA)

N67-21638# Argonne National Lab., Ill.
DEPENDENCE OF TRANSIENT HEAT TRANSFER ON HEAT FLUX DENSITY [ZAVISIMOST NESTATSIONARNOGO TEPLOOBMENA OT PLOTNOSTI TEPLOVOGO POTOKA]
E. V. Kudryavtsev and I. A. Turchin Oct. 1966 6 p refs Transl. into ENGLISH from Inzh.-Fiz. Ah. (Moscow), v. 10, 1966 p 573–576
(ANL-TRANS-393) CFSTI: HC $3.00/MF $0.65

Transient natural convection heat transfer at a thin Nichrome ribbon was studied. The temperature distributions at Δt = constant are presented and the relation between the heat transfer coefficient and the heat flux at the heat transfer surface is found. Author (NSA)

N67-21724# Toronto Univ. (Ontario). Inst. for Aerospace Studies.
SPECIFIC HEAT RATIOS AND ISENTROPIC EXPONENTS FOR CONSTANT-VOLUME COMBUSTION OF STOICHIOMETRIC MIXTURES OF HYDROGEN–OXYGEN DILUTED WITH HELIUM OR HYDROGEN
Andre Benoit Dec. 1966 31 p refs
(UTIAS-TN-102; AD-643670) CFSTI: HC $3.00/MF $0.65

This note is complementary to UTIAS Technical Note No. 85, 'Thermodynamic and Composition Data for Constant-Volume Combustion of Stoichiometric Mixtures of Hydrogen–Oxygen Diluted with Helium or Hydrogen', by A. Benoit (AD-623942). It includes the calculation of the equilibrium specific heats, the equilibrium specific heat ratios, the isentropic exponents, and the corresponding values of the speeds of sound. For convenience, the final-to-initial temperature ratio and the final-to-initial pressure ratio have also been included in the present tables. The results are presented for helium and hydrogen dilution respectively. Author (TAB)

N67-21751# Aerodynamische Versuchsanstalt, Gottingen (West Germany).
THE DETERMINATION OF THE THERMODYNAMIC STATE OF RELAXING HYPERSONIC GAS FLOWS BY ELECTRON BEAM TECHNIQUE [DIE BESTIMMUNG DES THERMODYNAMISCHEN ZUSTANDES RELAXIERENDER HYPERSONISCHER GASSTROEMUNGEN DURCH ELEKTRONENSTOSSANREGUNG]
K. Buetefisch Sep. 1966 45 p refs
(DLR-FB-66-63) CFSTI: HC $3.00/MF $0.65

For determining the thermodynamic state of relaxing hypersonic gas flows besides the static temperature and density also the vibration temperature must be measured. After discussing several possible measurement procedures a method for registering the vibration temperature with the aid of the electron beam technique on spectroscopic way is described. The special arrangement of the equipment makes it possible to register continuously at the same time besides the local vibration temperature also the local density as function of position or for a given position as function of total pressure or stagnation temperature. Author

N67-21823# Battelle-Northwest, Richland, Wash.
K-III, A THREE-REGION KINETICS CODE IN FORTRAN-IV
W. W. Little, Jr. Jun. 1966 40 p refs
(Contract AT(45-1)-1830)
(BNWL-252) CFSTI: HC $3.00/MF $0.65

A coupled neutronics-heat transfer kinetics code written in FORTRAN-IV is described. The power variation is computed using a lumped parameter model with up to six precursor groups. The spatial temperature distribution in three regions is computed in plane, cylindrical, or spherical geometry. Up to 30 spatial nodes can be employed. Both linear and Doppler reactivity feedback mechanisms are available. Although running time is highly problem dependent, a typical case requires about two minutes of UNIVAC-1107 time. Input information, a sample case, and a FORTRAN-IV source deck listing are given in the appendices.
Author (NSA)

34 GENERAL

Includes reports of a broad nature related to industrial applications and technology, and to basic research; defense aspects; law and related legal matters; and legislative hearings and documents.

N67-20413*# National Aeronautics and Space Administration Washington, D. C.
SOME NASA VIEWS ON FUTURE SPACE ACTIVITIES
Raymond L. Bisplinghoff *In its* 2d Ann. Meeting of the Working Group on Extraterrest. Resources [1964] p 11–17 (See N67-20412 10-24) CFSTI: HC $3.00/MF $0.65

Comments are made on space program appropriations, space activities beyond a manned lunar landing, and research being conducted on high energy propellants, nuclear rockets, electric propulsion, on-board electric power supplies, fuel cells, space environmental effects on physical and biological systems, meteorite hazards, and reentry.
R.N.A.

N67-20452# International Business Machines Corp., Gaithersburg, Md. Federal Systems Div.
ORGANIZATION AND PRESENTATION OF IMAGE INTERPRETER REFERENCE AND AUXILIARY INFORMATION
Arthur Nelson, Kenneth McClure, John Polgreen, and Robert Sadacca (Army Personnel Res. Office) Jun. 1966 119 p refs *Its* Tech. Res. Note-173
(Contract DA-49-092-ARO-7)
(AD-641326) CFSTI: HC $3.00/MF $0.65

The model, the task analysis results, and a survey of equipment for reference displays were all used to evaluate design alternatives for indexing, storage forms, storage media, and displays, as well as requirements and displays for auxiliary data. Three modes of TIIF operation-manual, semi-automated, and automated-were considered. Reference storage forms, media, and displays should be selected in the context of a manual or automated TIIF system. For a manual system, references should be in their original form and stored in file cabinets. For an automated system, references should be standardized according to interpreter needs and controlled by a computer processing unit. Reference indexes should be designed for each type of reference, utilizing existing indexes as far as possible. Collection and processing of auxiliary information should be automated for ease of subsequent processing. The code matrix block should be used whenever possible. The displays of auxiliary information should relate to whether the system is manual or automated. For the manual system, auxiliary displays should be viewed in hard copy or in the original format. For the automated system, displays, if needed, should be under computer control. Additional information for a code matrix block should include aircraft stabilization data.
Author (TAB)

N67-20591# Carnegie Inst. of Tech., Pittsburgh, Pa. Management Sciences Research Group.
ECONOMIC PROGRAMMING AND THE VON NEUMANN MODEL: SOME PLANNING TECHNIQUES
Roman L. Weil, Jr. Jun. 1966 149 p refs
(Contract Nonr-760(24))
(Rept.-78; AD-640478) CFSTI: HC $3.00/MF $0.65

The essays are concerned with generalizations, extensions, and applications of the von Neumann model. The essays all have in common a how to approach: Chapter II shows how to decompose a von Neumann model or an input-output model and how von Neumann expansion rates can be easily found once the decomposition is known; Chapter III shows how to find the von Neumann path and expansion rate; Chapter IV shows how to get onto the von Neumann path on an optimal way given a fixed-time constraint; and Chapter V shows how to introduce consumption into the closed von Neumann model or at least one way of attempting to do so.
Author (TAB)

N67-20628# System Development Corp., Falls Church, Va.
AN EXPERIMENTAL STUDY OF TWO METHODS OF INDEXING TACTICAL IMAGERY
Richard S. Laymon Washington, Army Personnel Res. Office, Jul. 1966 45 p refs Prepared Jointly with Army Personnel Res. Office *Its* Tech. Res. Note 176
(Contract DA-49-092-ARO-65)
(AD-643243) CFSTI: HC $3.00/MF $0.65

An experiment conducted to compare two methods--graphic and textual--of indexing reference materials for use of image interpreters in a tactical image interpretation facility is reported. The objective was to evaluate the two methods for speed and accuracy in locating rolls of reference imagery in a TIIF. Image interpreters trained in the use of area-oriented graphic and textual indexes to tactical imagery on roll film were required in two experiments to obtain from indexes the accession number of rolls of imagery containing coverage for a given area. Interpreter performance with both types of indexes was compared for accuracy and speed. Major findings were: (1) Interpreters took less time on the average with the textual index when areas were small; (2) with the graphic index, less time was taken when areas were large. The longer time taken with the textual index to locate desired imagery for large areas appeared due to recording and analyses tasks required under these conditions. Conclusions point to the greater utility of the graphic index in a manual image processing system where coverage of large geographical areas is required or if image coverage has to be precisely defined. The textual index appears more useful in a computerized system where coverage of small area targets with less definition is the major requirement.
Author (TAB)

N67-20632# Decision Science, Inc., San Diego, Calif.
ON THE DESIGN OF CONSCIOUS AUTOMATA Final Report
Lawrence J. Fogel 31 Oct. 1966 102 p refs
(Contract AF 49(638)-1651)
(AFOSR-66-2872; AD-644204) CFSTI: HC $3.00/MF $0.65

The report reveals that although the problem of discovering a mechanism for consciousness has long been of interest it remains unresolved in view of inadequate means for representing the logic of self-referential systems which interact with their own environment. A series of experiments were conducted wherein evolutionary programming was used to generate successive models of a time variant entity under various conditions of open and closed environment. It was shown that the use of a many-valued logic made it possible to resolve the problem of conflicting goals at different levels, these being confounded by the closed environment. This logic is considered with respect to the suggestions of Gunther and other philosophers. A proposed mechanism for consciousness

is indicated. Aspects of natural evolution are clarified as these might lead to means for simulating such consciousness. The importance of this problem area is stressed in the light of modern technological problems. Author (TAB)

N67-21295# Israel Program for Scientific Translations, Ltd., Jerusalem.

A NEW METHOD FOR CONTROLLING THE RESULTS OF HYDRAULIC FRACTURING BY MEANS OF RADIOACTIVE ISOTOPES

I. G. Zhuvagin and Yu. A. Akchas'yanov *In its* The Uses of Radioactive Isotopes and Nucl. Radiation in the U.S.S.R., Vol. 4 1966 p 120–127 (See N67-21281 10-13) CFSTI: HC $3.00/MF $0.65

Industrial test data are presented on a method for checking the results of hydraulic fracturing the petroleum reservoirs, which consists of tracing the variations in gamma radiation intensity in the fracturing zone during fracturing. Results indicate: (1) It is capable of definitely establishing the location of the fracturing zones, and of controlling repeated hydraulic fracturing by intervals. (2) It eliminates the downtiming of the well before and after fracturing, as well as flushing to remove radioactive contamination from the walls and bottom of the well. (3) It obviates idling of the well since results are obtained directly on the well. (4) In comparison to existing methods, cost savings are estimated at from 5000 to 7000 rubles for each well. M.G.J.

N67-21296# Israel Program for Scientific Translations, Ltd., Jerusalem.

NEW TECHNIQUES AND APPARATUS FOR STUDIES OF DISTRIBUTION OF CEMENT IN THE ANNULUS IN CASE WELLS

Yu. A. Gulin, D. A. Bernshtein, and Yu. I. Sokolov *In its* The Uses of Radioactive isotopes and Nucl. Radiation in the U.S.S.R., Vol. 4 1966 p 128–138 (See N67-21281 10-13) CFSTI: HC $3.00/MF $0.65

Details are given on a cementometer which investigates the well by means of mutually shielded indicators arranged at angles of 120° to record three gramma–gamma ray logs. To calibrate the instrument with respect to the well section, a neutron–gamma ray log (with a 30 cm tool) can be recorded on a fourth channel in addition to the gamma–gamma ray logs. The principal media determining the intensity of scattered radiation are identified as the jacket of the logging took, drilling mud in the well, casing string, cement or drilling mud in the annulus, and rocks. If the effect of the first three factors is assumed to be constant, then the variations in the recorded values of gamma–gamma ray logs will depend on the density characteristics of the medium filling the annulus, and on the rock density. Results of tests on models and in wells are given. An analysis of the data indicates: (1) The cementometer permits a reliable determination of the height of the cement column in the annulus. (2) The method is very sensitive to the presence of water in the annulus. (3) The centograms provide information on the position of the string in the walls. M.G.J.

N67-21297# Israel Program for Scientific Translations, Ltd., Jerusalem.

APPLICATION OF THE RADIOACTIVE HYDROGEN ISOTOPE-TRITIUM TO STUDIES OF THE MOVEMENT OF WATER IN THE RESERVOIRS IN THE INVESTIGATION AND EXPLOITATION OF OIL DEPOSITS

N. A. Vasil'eva, E. V. Sokolovskii, and V. N. Maidebor *In its* The Uses of Radioactive Isotopes and Nucl. Radiation in the U.S.S.R., Vol. 4 1966 p 139–147 (See N67-21281 10-13) CFSTI: HC $3.00/MF $0.65

In the experiments, tritium was introduced into a reservoir composed of fine-grained quartz sandstone, together with the injected water through the injection well in one portion. The reservoir was in the area of an injection well and three producing wells. An automatic sampler was used for an around-the-clock taking of average samples from the producing wells. Geiger–Muller type counters were used to measure tritium activity. Analysis of the samples showed that the first portions of the tracer fluid arrived at the producing wells after short periods of time; this arrival corresponded to an average velocity of 55 m/24 hrs. It was concluded that the specific features of the structure of the collector caused the tracer fluid not to move in a single front. Although part of the fluid arrived rapidly at the producing wells through highly previous zones, the principal contour moved through a relatively homogeneous medium of the reservoir, obeying the laws of liquid filtrations. Summary data are also presented on the use of tritium to study hydrodynamic communication between individual intervals of the producing formation of an oil field situated in fractured deposits. M.G.J.

N67-21299# Israel Program for Scientific Translations, Ltd., Jerusalem.

CRITICAL DIMENSIONS OF A RESERVOIR MODEL FOR SIMULATING RADIOACTIVITY METHODS FOR THE INVESTIGATION OF WELLS

A. V. Zolotov *In its* The Uses of Radioactive Isotopes and Nucl. Radiation in the U.S.S.R., Vol. 4 1966 p 154–161 (See N67-21281 10-13) CFSTI: HC $3.00/MF $0.65

The critical dimensions of the reservoir model are examined in relation to different radioactivity logging methods. These are defined as the relationship between the variation in the density of neutrons or gamma radiation along the well-axis (or at the center of the sphere), and the variation in the dimensions of the reservoir. The dimensions are equal to the radius of a rock sphere which emits 98% of all neutrons or gamma radiation recorded by the counter. These dimensions are then examined in relation to the different radioactivity logging techniques employed, with attention focused on gamma ray logging, and the isotope and neutron methods. M.G.J.

N67-21315# Israel Program for Scientific Translations, Ltd., Jerusalem.

PREVENTION OF THE EMERGENCE OF THE DRILLING TOOL FROM THE COAL SEAM IN DRILLING INCLINED BORE-HOLES IN THIN SEAMS

E. M. Belyanova, K. A. Kuznetsova, I. D. Mysakovskaya, P. F. Puzyrev, and D. A. Sokolov *In its* The Uses of Radioactive Isotopes and Nucl. Radiation in the U.S.S.R., Vol. 4 1966 p 288–295 (See N67-21281 10-13) CFSTI: HC $3.00/MF $0.65

A method of radioactive preventive control is described. This is based on continuous measurement of scattered gamma radiation in the borehole during drilling, and the use of differences in the densities of coal and containing rocks. The phenomena of photoeffect, Compton scattering, and pair formation are examined in relation to variations in gamma radiation energy, and the substance. Also described is the commercial apparatus for preventive control. This consists of a spherical bit containing a chamber for the Co^{60} source of gamma radiation; gamma radiation source of 20 mc; two logging tools; connecting line; collector; and control panel. Examples are given to show that use of the method makes it possible to drill a borehold within the coal seam, and avoid the emergence of the drilling tool into the containing rock. The method can also be used in continuous mining machines for controlling the thickness of the coal bench which is left in the case of a weak roof; on crosscutting machines to control their orientation with respect to the contacts of the coal seam; or to control the drilling of detonating holes in coal seams in longwalls. M.G.J.

N67-21355# Stanford Univ., Calif. Inst. for Mathematical Studies in the Social Sciences.

THE NATURE OF FLOOD CONTROL BENEFITS AND THE ECONOMICS OF FLOOD PROTECTION

Robert C. Lind 12 Dec. 1966 109 p refs

(Contract Nonr-225(50))

(TR-145; AD-644307) CFSTI: HC $3.00/MF $0.65

The paper deals with the problem of assessing the benefits from various types of flood protection. The first chapter contains a discussion of the nature of the benefits from flood protection and relates the various types of benefits to five different measures for coping with flood losses. The second chapter develops a theory of land use as it relates to the structure of rents. This theoretical framework is used in Chapter III to develop the proper measure of benefits from land enhancement. The final chapter deals with the effects of alternative programs of insurance on the cost of risk-bearing associated with flooding. Author (TAB)

N67-21434# Illinois Univ., Urbana. Group Effectiveness Research Lab.

SOCIAL STATUS AS A DETERMINANT OF RESPECT AND FRIENDSHIP ACCEPTANCE

Harry C. Triandis, Vasso Vassiliou (Athenean Inst. of Anthropos), and Erich K. Thomanek Aug. 1966 30 p refs

(Contract Nonr-1834(36); ARPA Order 454)

(TR-37; AD-643275) CFSTI: HC $3.00/MF $0.65

Previous work completed with American student Ss has shown that the behavioral component of interpersonal attitudes is multidimensional and the affective component is related to only one of the factors of the behavioral component. A theory is presented which accounts for these findings. One aspect of the theory predicts that each of the factors of the behavioral component of interpersonal attitudes is determined by different combinations of the parameters sex and status. The present study inquired on the generality of this finding by testing a representative sample of 400 from Athens, Greece. Previous work was replicated with some slight modifications. It was found again that two of the factors of the behavioral component of attitudes, Respect and Friendship, are orthogonal. Respect is a positive function of the status of the stimulus person and a negative function of the status of the subject making the judgments. Friendship is an inverse function of the difference in status between the stimulus person and the person making the judgments; it is also a function of the similarity in the sex of the stimulus and the person making the judgments. Author (TAB)

N67-21746# Eidgenossische Technische Hochschule, Zurich (Switzerland).

QUANTIFICATION OF THE CONNECTION OF A GROUP OF FACTORS IN A PRODUCTION PLANNING SYSTEM [QUANTIFIZIERUNG DES ZUSAMMENHANGES EINER GRUPPE VON EINFLUSSGROESSEN IN EINEM FERTIGUNGSLENKUNGSSYSTEM]

Beat Fischer (Ph.D. Thesis) 1966 193 p refs In GERMAN

(Rept.-3696) CFSTI: HC $3.00/MF $0.65

Stochastic factors which affect targeting processes and load calculations in production are placed into quantized dependence. Monte Carlo simulation methods are preferred for this purpose over purely mathematic-analytic solutions in order to facilitate computer processing of the data. Factors and random values of a model for work load are arranged to provide a constant flow of work. Guide lines are given for calculating idle time as a function of work process factors. The effects of various target time units are investigated. Although the model operates with relative values, absolute values can be derived. The theoretical and practical distribution factors are applicable in medium and large plants of the machining and metal industries. A computer program for problem simulations is included. Transl. by K.W.

N67-21761# Kernforschungsanlage, Juelich (West Germany). Rechts- und Wirtschafftswissenschaftliche Arbeitsgruppe.

DAMAGE CAUSED BY RAYS [RECHTSPROBLEME BEIM KAUSALITAETSNACHWEIS VON STRAHLENSCHAEDEN]

Werner Schuelli (Muenster Univ.) Mar. 1964 247 p refs In GERMAN

(JUL-143-JU) CFSTI: HC $3.00/MF $0.65

Examined are problems in connection with the burden of proof in civil damage suits when cause of radiation injury or damage must be proven by the plaintiff. Defined are the various types of radiation, possible injuries, causality and liability, and philosophical and scientific aspects of "cause". Also discussed are pertinent German, British, French, and American laws, simplification of the burden of proof for the plaintiff, collective liability, and new approaches to radiation damage compensation. Transl. by K.W.

N67-21871# System Development Corp., Santa Monica, Calif.

A BIBLIOGRAPHY ON INFORMATION SCIENCE AND TECHNOLOGY FOR 1966, PART III Technical Memorandum

Frances Neeland 25 Nov. 1966 98 p

(TM-3008/003/00-PT-3; AD-645442) CFSTI: HC $3.00/MF $0.65

The primary aim of this continuing bibliography is to assist the authors of the chapters in Annual Review of Information Science and Technology in discovering the existence or determining the identity of documents relevant to their topics. The style of entries also reflects the authors requirements. The Abbreviations and Index for Periodicals Cited is cummulative for parts I through III. Author (TAB)

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